American Machinist / Metalworking Manufacturing

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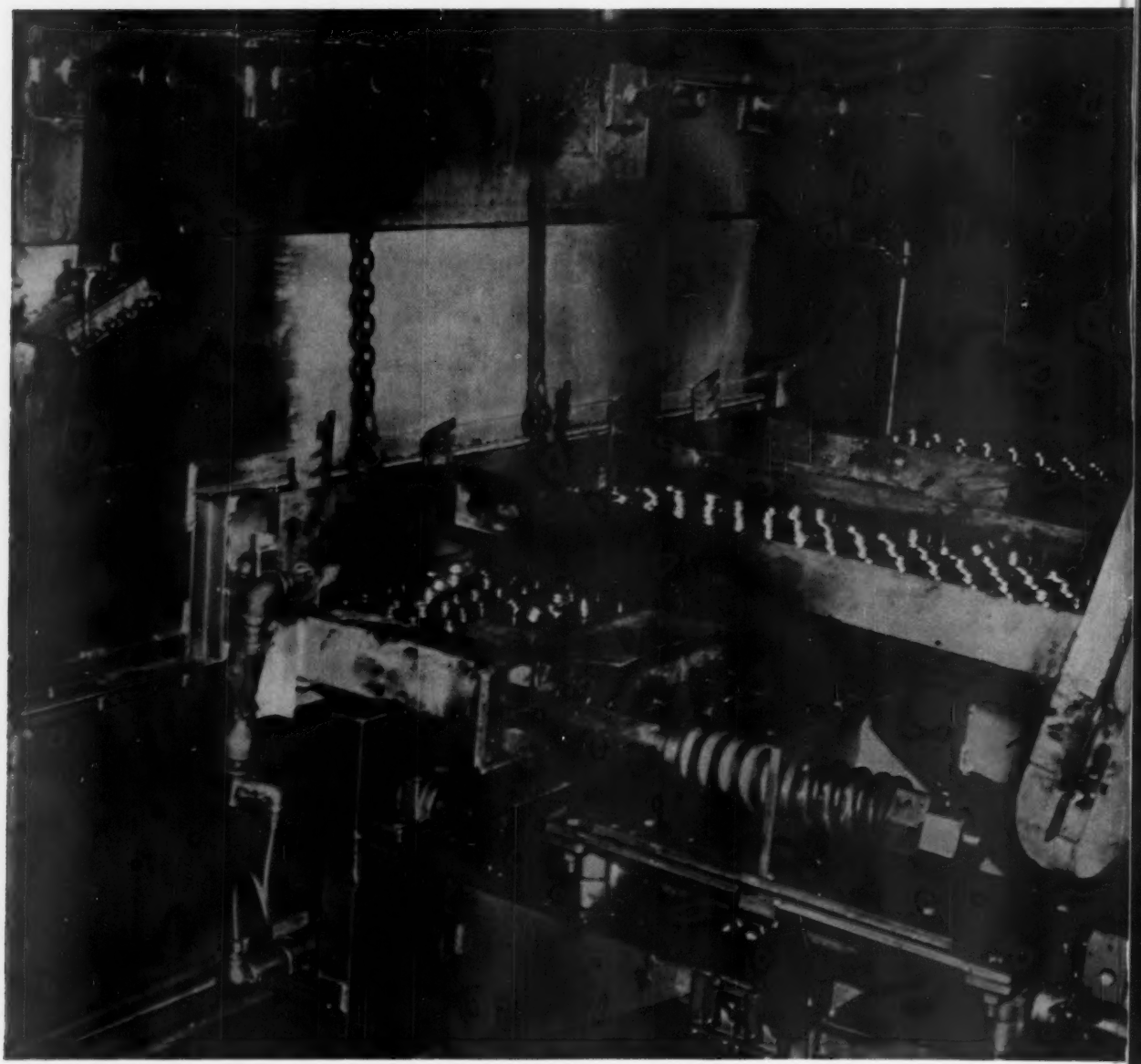
Special Report, Page 111

GUIDE TO LEADED STEELS



Ball-bearing races enter hardening furnace in new twin-line setup—see page 128

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- **The case of the metallurgical sleuth,** p100
- **Will an existing cutter shave a new gear?** p106

METAL SHOW ISSUE

A NEW TOOL-SETTING METHOD

Tool-Tronic Gage locates tool tip within .000025 by fast, simple electronic-optical method

by Alden H. Jacobson, Chief Engineer
Bore-Matic Division
The Heald Machine Company

With today's trend to greater accuracy and precision in single-point Borizing, the problem of precise tool-tip location becomes increasingly important.

Previous methods, while of high accuracy, are relatively slow and require considerable skill on the part of the operator. The optical method, using a precision-calibrated microscope, is dependent on the relative degree of operator eye fatigue. If eyestrain is a result, such an undesirable condition is known as "eyeballing." And the touch method, using dial indicators, often causes microscopic damage to the cutting edge with resulting impairment of the finished surface.

Here at Heald we have devoted a great deal of research to devise a method of tool-setting which would maintain the highest accuracy, prevent tool tip damage, and require no special operator skill.

The result is the new Tool-Tronic Gage illustrated here. Tool tip location is precisely determined by optical means, with electronic amplification giving highly accurate readings on two large meter scales.

The unit consists essentially of a sensing head which contains the light source, optics and photo cells, and a separately mounted amplifier and meter case. The sensing head is mounted vertically on the machine near the workhead, where the tool can be positioned into gage opening. As the tool is moved into place by operation of the table and cross slide, it interrupts the light rays and the amount of light passing on each side of the tool is compared to reference photocells and read out on two large horizontal-scale meters. To locate the tool with an accuracy of 25 millionths, it is only necessary to move tool in X and Y directions until the pointers on both meters are centered on the "zero" mark. For the operator to determine this precise position and return to it whenever desired requires no more skill or experience than that needed to operate the machine.

The Tool-Tronic Gage can be used with most types of single-point boring and turning machines. It should prove especially valuable on numerically-controlled contour Borizing equipment where extreme precision is required.

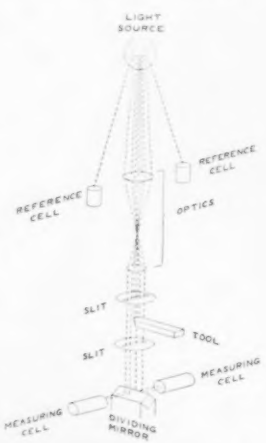


Diagram showing principle of operation of Tool-Tronic sensing head.

Tool-Tronic Gage, showing meter case, sensing head and cable.

Tool-Tronic gage in use on a numerically-controlled Heald Model "S" Bore-Matic. Sensing head (arrow) receives tool and centering indication is read on meters at right.

Your Heald engineer will be glad to arrange a demonstration of this new tool setting gage for you, in your plant or ours.

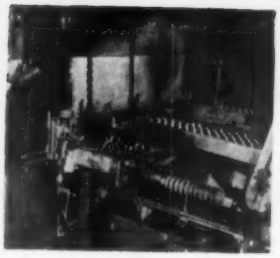
It Pays to come to Heald

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 251 READER SERVICE CARD

COVER:

Ball-bearing races enter Sunbeam hardening furnace in twin-line setup at SKF Industries' new ball-bearing plant in Altoona, Pa. See page 128.



American Machinist / *Metalworking Manufacturing*

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TURN PAGE FOR METALWORKING REPORT ——►

METALWORKING REPORT

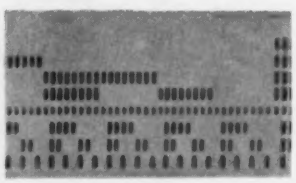
. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

MATERIALS . . . A little tellurium in leaded steel gives the fastest-cutting screw-machine stock ever, according to LaSalle Steel Co. The tellurium steel, developed by Inland Steel Co, is cold-finished by LaSalle into barstock and called La-Led-X. Inland has turned spark plug shells from the stock at 618 sfm—**more than 3 times the speed formerly recommended.** At the same time, **cutting feeds were increased 1/3 over normal.** Addition of tellurium ups normal barstock prices about $15 a ton. More details on p89. Also, advantages of leaded steel are discussed in the special report, starting on p111.

HEAT TREATING . . . A new high-purity open-chamber furnace from C I Hayes (Cranston, RI) provides the **rapid temperature response** and maintains the **low dew points** necessary for proper heat treatment of tool steels. Furnace, which can also be used for sintering, brazing, and general heat treating, will be but **one of many new heat treating developments** on display at the Metal Show in Detroit's Cobo Hall. For a full rundown on the technical sessions and the show, see p119.

CLEANING . . . Chloroform does the cleaning of sapphire bearings that go into gyros built at a British plant (English Electric Aviation, Ltd). A jet of heated air (200 F) sprays the solvent through a fine nozzle, then a stream of hot air dries parts. The operation takes place in a cabinet located in the assembly "white" room. **All other bearing parts are cleaned five times in warm, redistilled Freon that is agitated by ultrasonics.** The fifth change is vacuum filtered; specifications require that not more than five particles, each under 50 microns, be visible on the filter at 60X magnification.

MATERIALS . . . High-field superconducting wire makes possible a new superconducting magnet that Westinghouse research has developed. The wire is a niobium-zirconium-base alloy. No larger than a doughnut, the magnet weighs only a pound, and is powered by an ordinary automobile storage battery to produce a flux density of 43,000 gauss. This strength is twice that of an iron-core electromagnet as large as an automobile that weighs 40,000 pounds and that, operated to saturation of the iron, requires 100,000 watts to run it. **These magnets are expected to revolutionize every aspect of man's use of electricity.** (Superconductivity occurs at –450 F, with the coil immersed in liquid helium.)



CONTROLS . . . Paper tape with electrostatically printed spots instead of punched holes has been developed by Omnitronics, Inc, a subsidiary of Borg-Warner, in Philadelphia. The tape with its "oblong" holes is said to **convey information at speeds over 1000 characters per second,** and to have a higher density recording. Company also makes line of input-output devices, called Omni-Data, that can **read all types of tape**—opaque, translucent, and transparent—**interchangeably with no modifications to the equipment.** The tape is read by chopped, reflected light in a no-impact, no-contact system.

MANUFACTURING CONTROL . . . The first book-length study of Value Analysis is just off the presses. Appropriately enough, the author is Lawrence D Miles, who developed the technique for General Electric some years ago. Here is the definitive treatment of Value Analysis, which has been widely adopted by industry and the military during recent years. **Full details on how to set up a Value Analysis program, and how to make the program work,** are given in the book published by McGraw-Hill.

ASSEMBLY . . . Adhesive bonding two mating instrument manifold sections instead of assembling with conventional fasteners and sealers **has cut production costs 50%** per manifold assembly at Taylor Instrument, Rochester, NY. Die-cut Scotchweld (Minnesota Mining and Mfg Co) AF-6 film adhesive is placed on one section, then the two sections are drawn together with plain steel screws (to provide pressure necessary for curing). The assembly is then spray painted with epoxy enamel. **Furnace curing** for 1 hr at 350 F **cures both the adhesive film and the enamel finish.**

COMPONENTS . . . Stronger ball-bearing retainer cages can be made by welding rather than riveting, according to The Fafnir Bearing Co (New Britain, Conn). The company has developed a welding technique that **increases the pull-apart strength to 1.72 times** that of riveted retainers, and should increase cage life in rugged applications. Company claims that the welded retainers are also **more precisely aligned because the halves are located by electrodes during welding,** don't rely on rivet holes or notches.

WELDING . . . Compromise between Tig welding and plasma welding for refractory metals is recommended by O Preston of Stanford Research Institute as a result of a study sponsored by the Bureau of Naval Weapons. Tests showed that high-velocity plasma torch spatters the weld metal; low-velocity torch has low heat transfer. However, the Tig torch, Preston says, **could be improved with some plasma-torch features:** decreased nozzle size plus a sustained arc within the nozzle when not welding.

Continued on next page

Coming in AM/MM
How to PROVE THE PROFIT
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This significant special report will analyze the unique problems in making a cost study of a numerical control installation. It will show why the normal rules of justifying a new equipment investment are not adequate, and analyze the special factors that do apply.

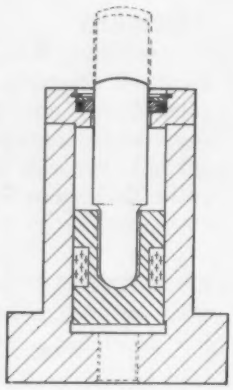
A major feature of the report will be a tabulation of data on the numerically controlled machines and systems now available.

This report will be invaluable in helping you determine when you should—and should not—invest in machines with numerical control.

METALWORKING REPORT . . .

COMPONENTS . . . A high-lubricity coating gives a lifetime of maintenance-free operation to a new valve. Developed by Rockwell Mfg Co, the valves (called Permaturn) are also said to be easier to turn. For low-pressure work, the coating is Teflon. **High-pressure valves get a combination coating of phosphate and molybdenum disulfide.** The Permaturn name is replacing the familiar Rockwell-Nordstrom name in the company's line of lubricated plug valves.

FORMING . . . A new hydraulic die cushion will run one million cycles without maintenance. That's the record reported for Hyson SA die cylinders, which have a **design that prevents misalignment of the cylinder-bore axis and the line of die travel.** Normally, slight misalignment causes lubrication failure and scoring, and the die must go out of service until the cushion is repaired. **In the new die cylinder, the piston and piston rod are not rigidly connected.** Instead, a ball joint is produced by putting a ball end on the rod to mate with a spherical seat in the piston. A "floating" guide ring replaces the conventional piston-rod bearing to keep out dirt. Sizes available range from 1¼-to-3-in. piston diameter for pressures to 4000 psi. Loads handled equal the piston area times 3000. Maker is Precision Products, Inc, Cleveland.



BRAZING . . . Brazed honeycomb is stronger than adhesive-bonded honeycomb, especially at elevated temperatures. The material is being produced by Tri Metal Works, Inc (Riverton, NJ) with a new vacuum brazing process in which the whole furnace is evacuated to 1 x 10^{-4} mm Hg. **The furnace,** which is 8 ft by 7 ft by 16 ft long, **can be evacuated in 30 minutes.** The complete brazing cycle takes about three hours.

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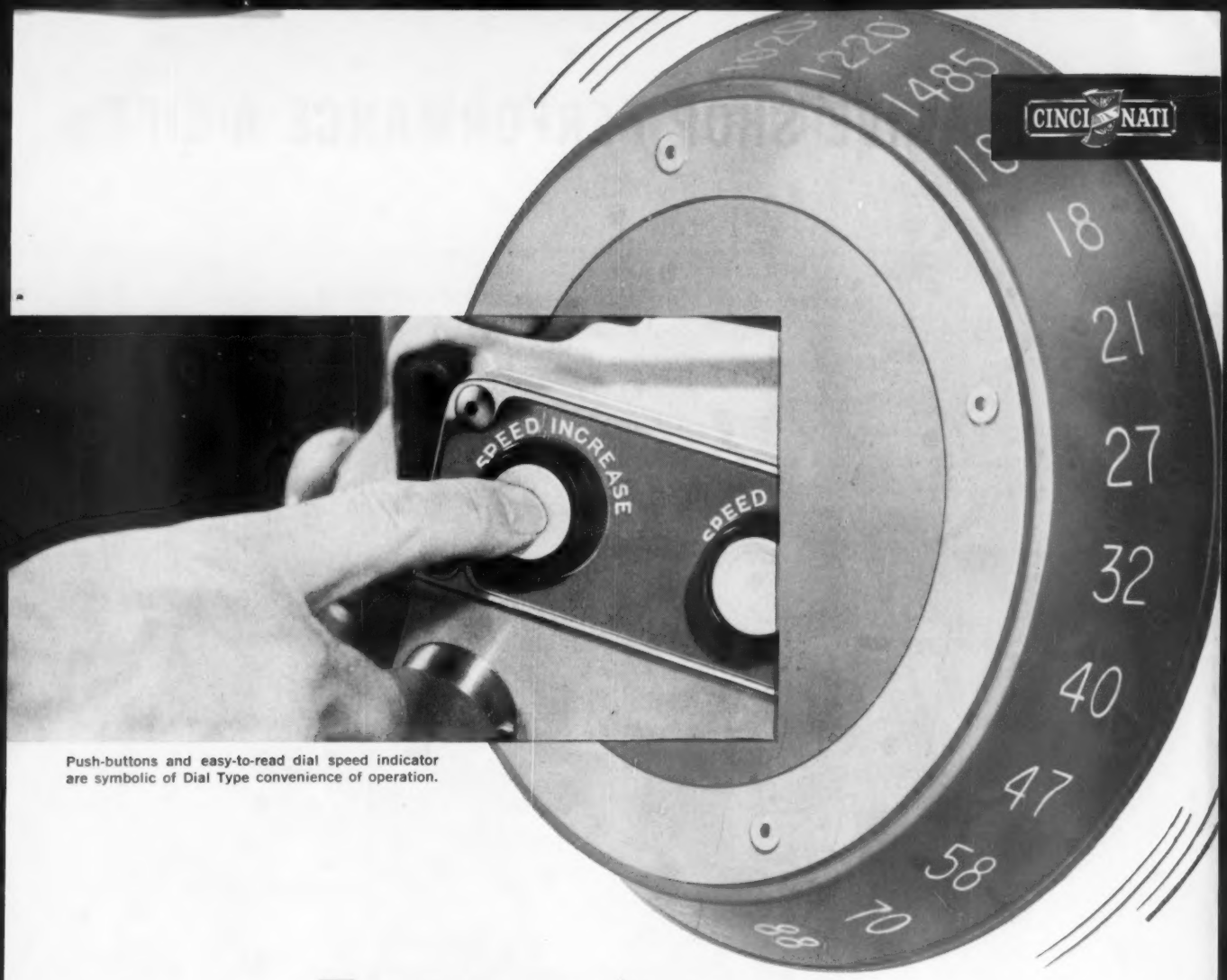

Push-buttons and easy-to-read dial speed indicator are symbolic of Dial Type convenience of operation.

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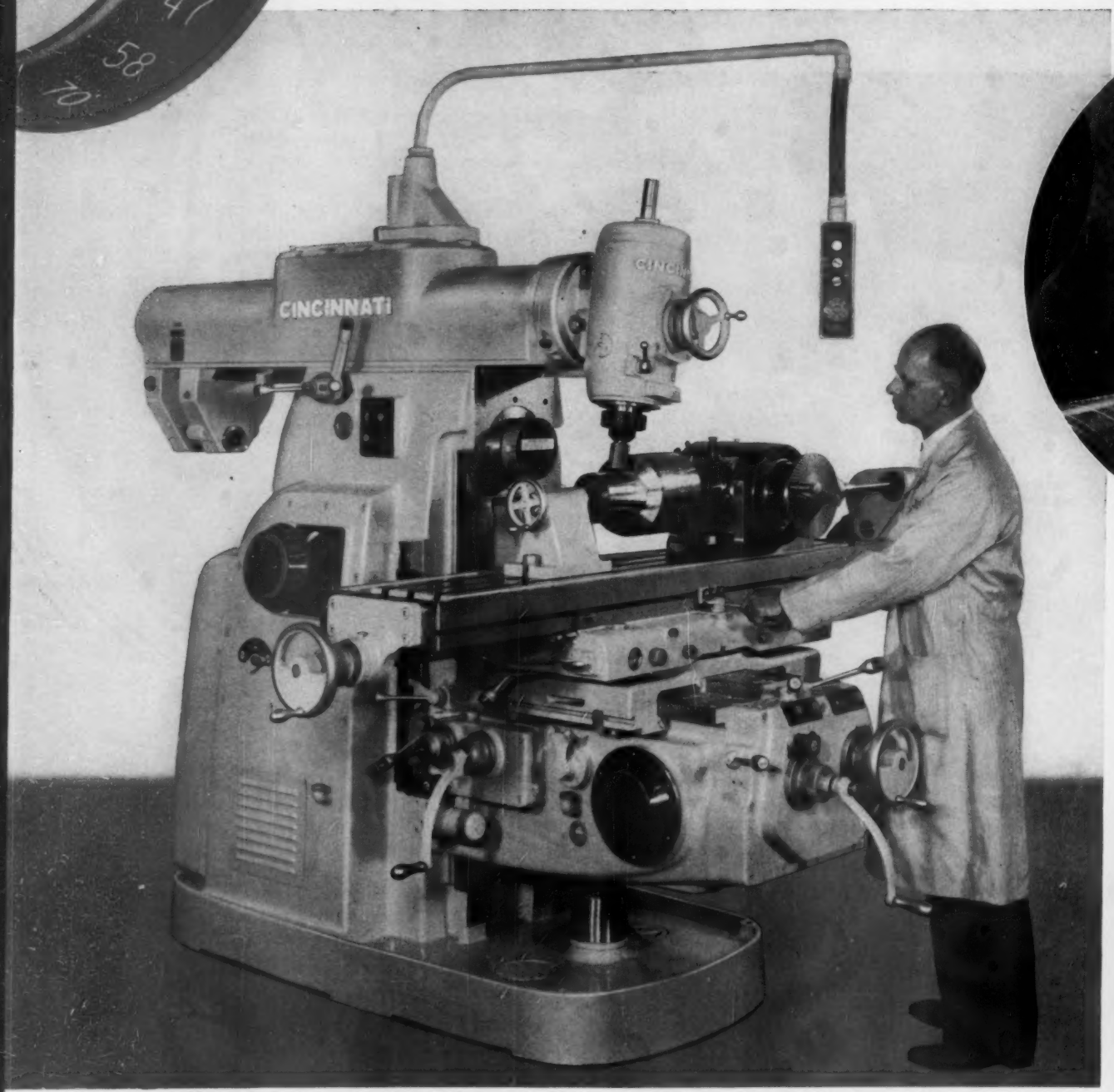

Versatility for toolroom milling is evident in this setup on a Universal Dial Type, equipped with Independent Overhead Spindle and Heavy Duty Tailstock for Dividing Head. Catalog M-2003-2.

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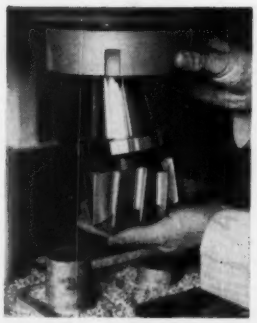

Within seconds, many types of arbors and adapters can be interchanged ... an exclusive Arbor-Loc feature-advantage.

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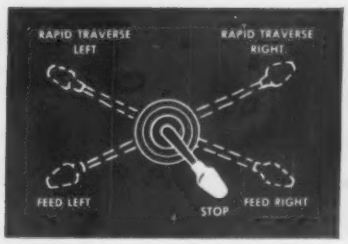
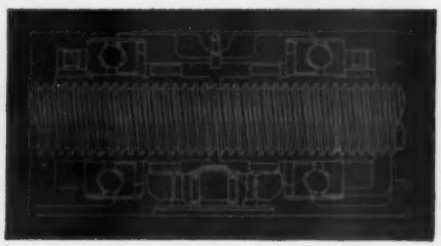


Five-position lever, automatic cycle Dial Types, gives the operator complete one-hand control of table movements.



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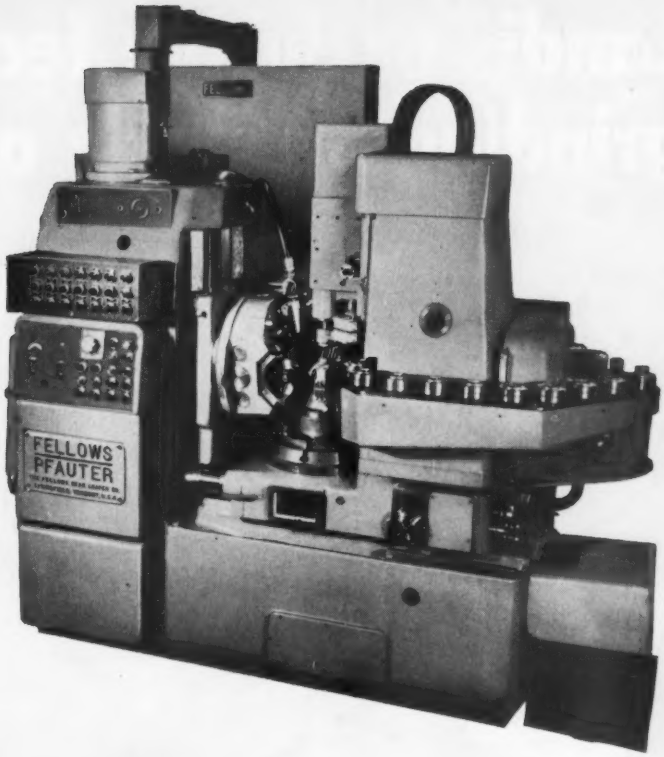
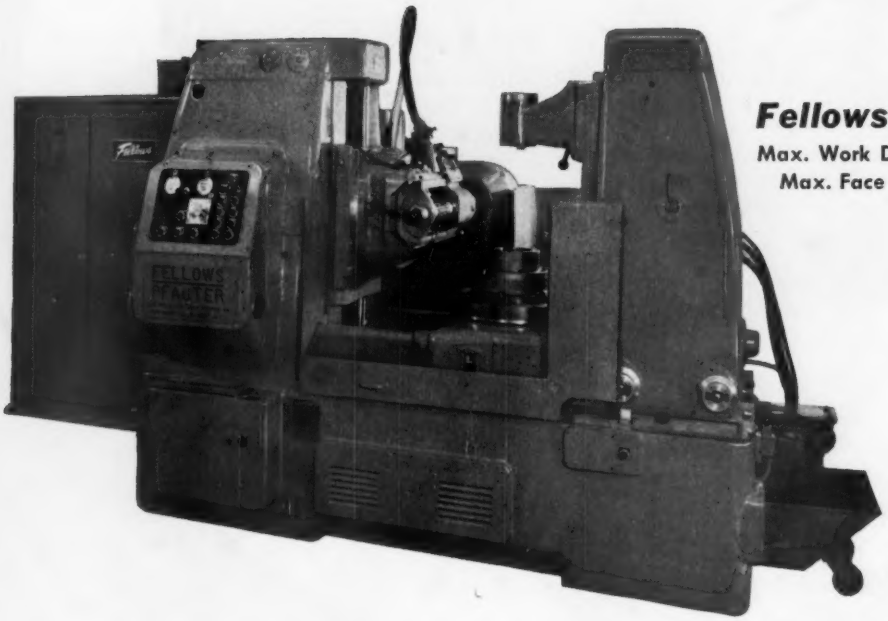


Fellows-Pfauter P400

Max. Work Dia. — 16″; Max. D.P. — 4;
Max. Face Width — 11″ at 16″ dia.;
Hob R.P.M. — 80-500.



Fellows-Pfauter P630

Max. Work Dia. — 25″; Max. D.P. — 3;
Max. Face Width — 16¼″ at 25″ dia.;
Hob R.P.M. — 62-390.

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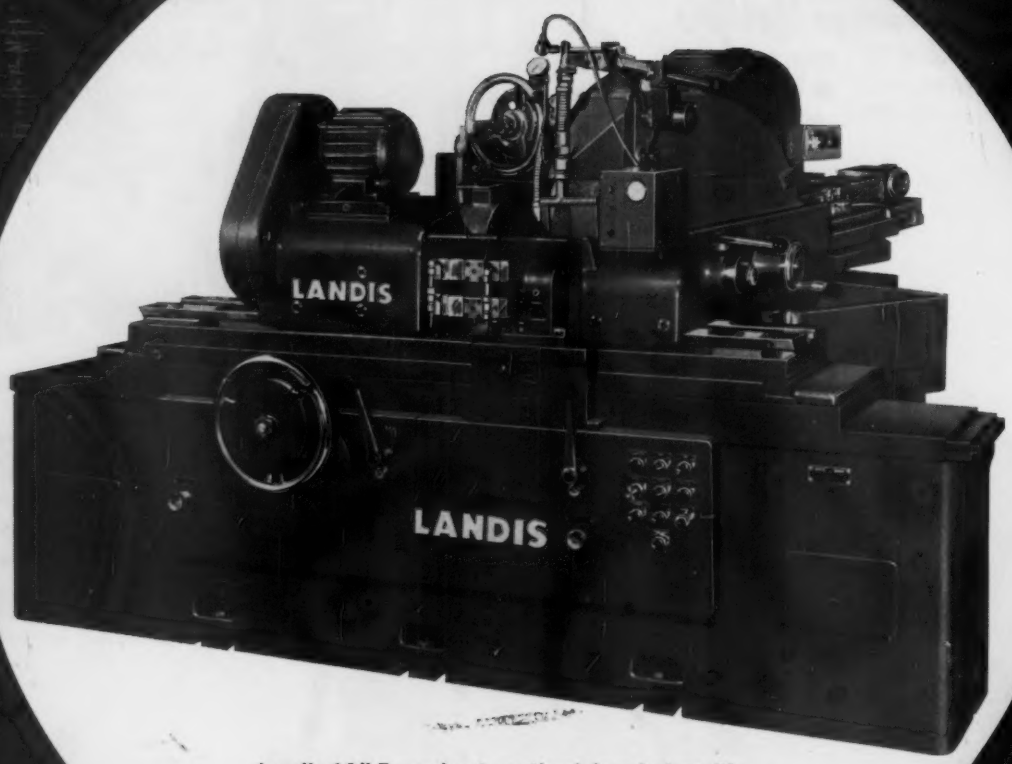

Landis 10" R semi-automatic plain grinder with angular wheelhead combines all new features

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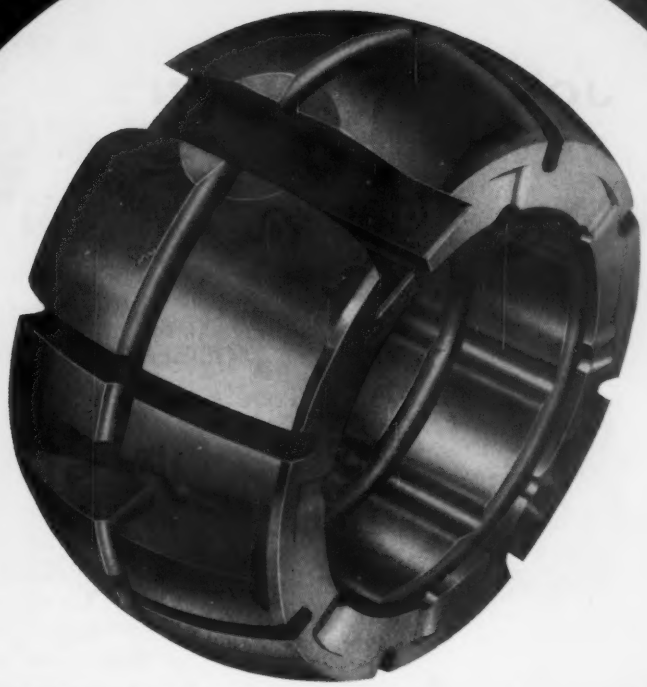
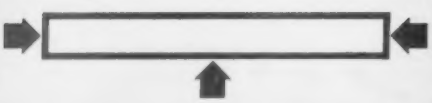
PRODUCTION

The new Landis plain cylindrical grinders are designed with a **combination** of exclusive features to improve the major factors that affect grinding quality and unit costs. These new machines will deliver reliable quality production meeting your most stringent requirements for precision and output.



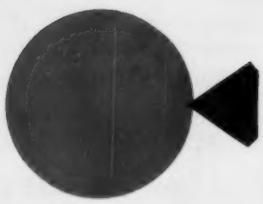
Wheel support. Exclusive Landis Microsphere wheel spindle bearing assures less sparkout time, finer finishes, faster production.



Work support. Exclusive wedge work rest and loaded ball spindle footstock give maximum rigidity to work parts.

exclusive Landis features
combined for lower cost and accuracy

Wheelfeed. Exclusive Landis Microfeed® is a pulse feed in millionths to final size that meets closest tolerances on a production basis.



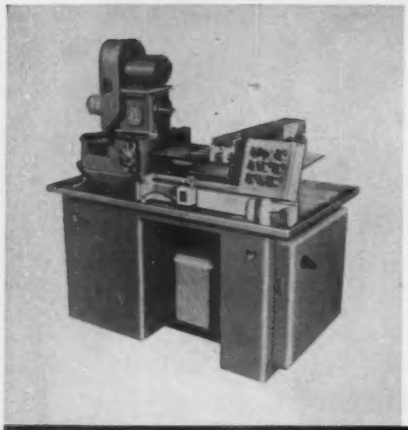
Wheel dressing. Exclusive Landis Truform dresser with ball slide, shake-free construction. Assures exact duplication of all wheel profiles.

LANDIS

LANDIS TOOL COMPANY, WAYNESBORO, PA.

JONES & LAMSON'S *NEW* PRECISION LINE of smaller machines

precision performers in the under $10,000 price range.



MODEL 6 PRECISION BORING MACHINE

FEATURES:
- choice of three automatic cycles
- push button operation
- varied chucking for rotating either tools or work
- applicable for multiple spindles

write for folder #6016

SPECS:

Swing — 10″ dia. max., Stroke — 7⅝″ max.
Bore — .090″ dia. min., 3″ dia. max.

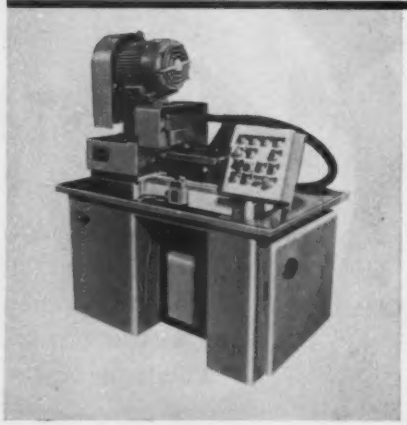
MODEL 410 PRECISION THREAD GRINDER

FEATURES:
- stark simplicity in set up and operation — push button control
- pre-packed work and wheel spindles — lubricated for life
- dual lead compensation (short & long)
- all machine slides are on pre-loaded rollers for smooth accurate traverse

write for folder #6015

SPECS:

Work Dia. — 4″ max., Thread Length — 10″ max.
Wheel Speeds — 2700 RPM



MODEL 6D PRECISION GUN DRILLING MACHINE

FEATURES:
- high penetration rates (12″ per min. not unusual)
- automatic cycling — push button control
- spindle distributes 12-15 gals. of coolant per min. at 2,000 PSI
- infinitely variable and constant feed rate

write for folder #6014

SPECS:

Spindle Speeds — 15,000 RPM, Max. Length of hole — 6″,
Dia. of hole — ½″ max., .074 min., Stroke — 7¾″ max.

JONES & LAMSON

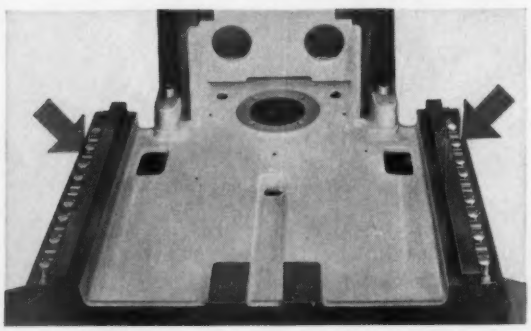
THREAD TOOL DIVISION

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt., U. S. A.

For precision and ease of operation

The only 618 surface grinder with roller bearings on both table and saddle bed ways

Antifriction roller bearings on precision ground table ways give easy operation. Work is always contained between saddle ways.



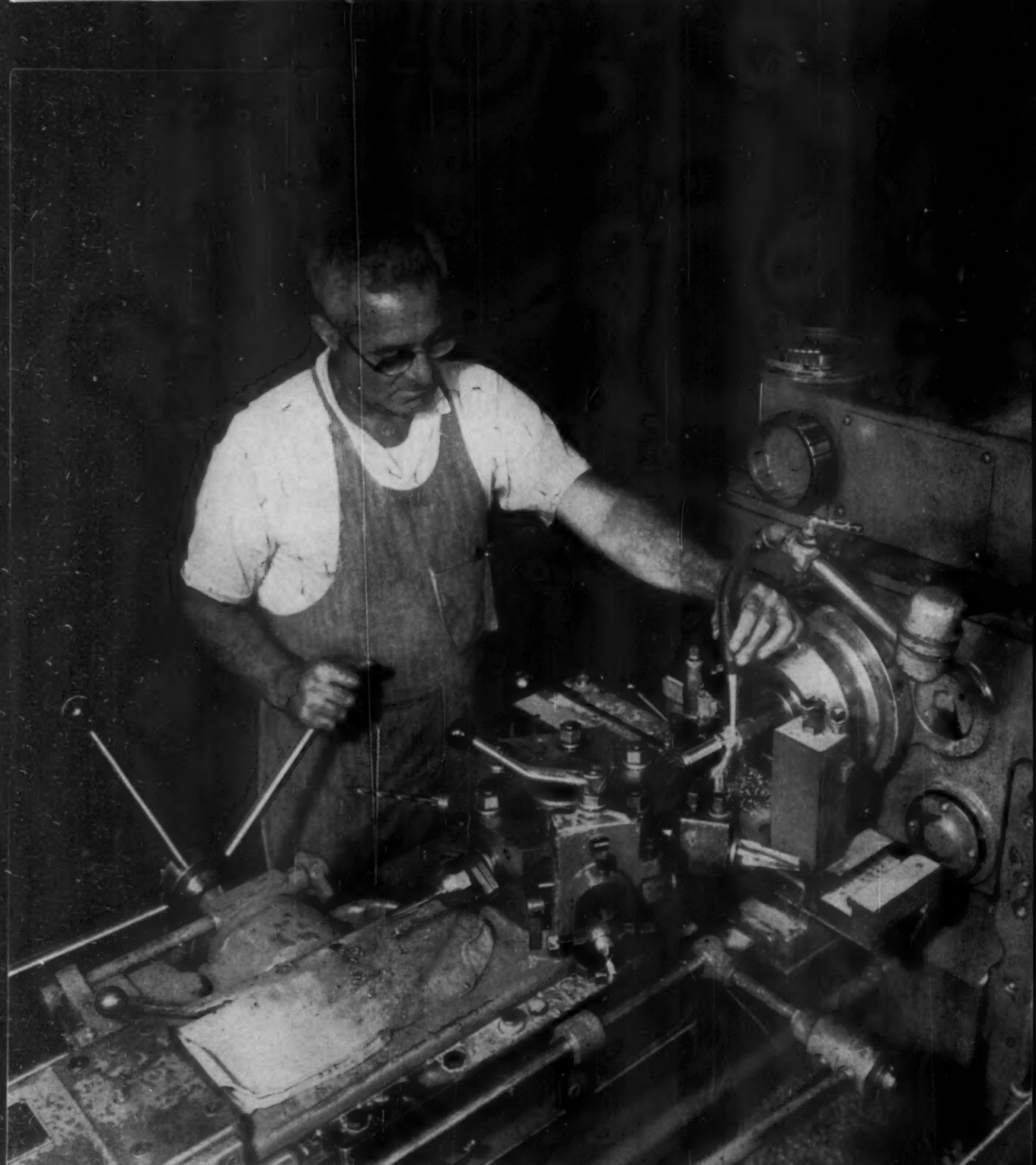
For maximum accuracy roller bearings on precision ground bed ways minimize the rise and fall caused by oil film build-up.

specifications—Landis Abrasive 618

Worktable capacity	6″ x 18″
Standard wheel diameters available	7″ or 12″
Capacity under 7″ wheel	14½″ to table
Capacity under 12″ wheel	12″ to table
Spindle drive motor: 7″ wheel	1 hp
12″ wheel	2 hp
Net weight	1,820 lbs.

LANDIS
ABRASIVE

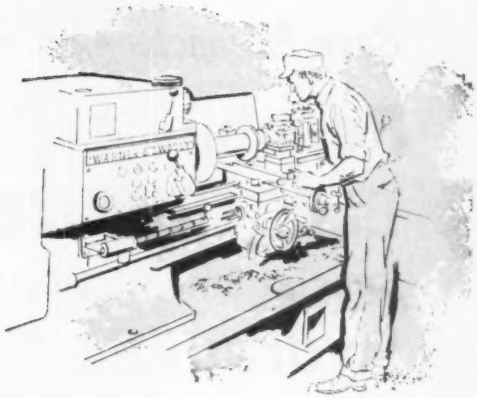
Landis Tool Company, Waynesboro, Penna.



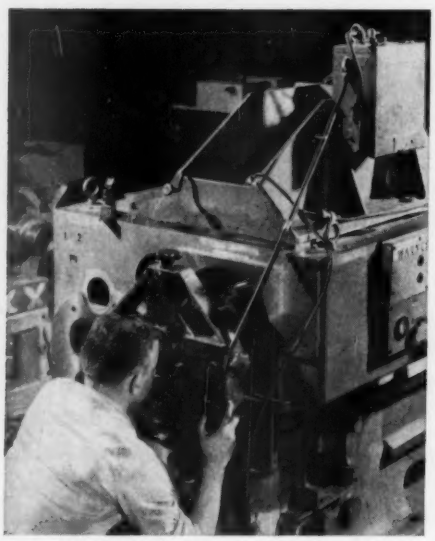
On the new No. 4 you can expect big reductions in handling time on jobs like these. Each machine in the Warner & Swasey line is individually designed for maximum efficiency and production in its own work range. As a result, operators like these machines for their easy handling and dependability in holding size.

At B-I-F INDUSTRIES, INC.

Providence, Rhode Island



.0005" tolerances and 32 micro-inch finishes held in tough metals



Permanent Accuracy—inherent in a Warner & Swasey turret lathe—begins with this optical method for precise alignment of the spindle with the bedways. Elsewhere in the shop, W/S machinists depend on master fixturing, precision finishing operations and careful fitting to assure lasting accuracy in Warner & Swasey turret lathes.

Holding size and finishes like these is simplified by the smooth running headstock, easy handling and dependable accuracy of the Warner & Swasey No. 4 Turret Lathe.

B-I-F INDUSTRIES has found that the built-in accuracy and the many new features of their No. 4 Warner & Swasey turret lathe have helped to eliminate the extra finishing operations formerly required on the work. In addition to better work finish, the vibrationless, all-clutch headstock has contributed to longer cutter life.

On small lots averaging 50 to 200 pieces—as well as on occasional lots of 3 or 4 pieces—their costs have been reduced because of the No. 4's higher speeds, greater horsepower, ease of setup and faster machine handling.

Why not check with your Warner & Swasey Field Engineer today for more information about the many new cost cutting features now available in our ram type turret lathes. Warner & Swasey Co., Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER, FOR LESS
...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

Save on material cost
Save on machining

Republic ELECTRUNITE Special Smooth I.D. Hydraulic Cylinder Tubing

the tubing that can often be delivered as a finished part

Precision controlled wall thickness with uniform concentricity makes ELECTRUNITE Special Smooth I. D. a finished part ready for use without machining in many hydraulic applications.

Because you can order ELECTRUNITE in exacting wall thicknesses, there's no need to pay for extra metal which may ultimately be machined away.

Only selected quality flat rolled steel is used in making ELECTRUNITE Special Smooth I.D. Hydraulic Cylinder Tubing. Thickness of this steel is precisely controlled in rolling, assuring uniform wall thickness of the finished tubing.

All tubing is welded by the exclusive ELECTRUNITE process *without addition of extra metal*, assuring that the weld area is of the same chemistry as the rest of the tube. In the processing, lengths of tubing are normalized in a controlled atmosphere furnace, completely recrystallizing the weld area to provide a uniformly ductile tube.

Tubing is drawn through a ring die and over a highly polished mandrel, attaining exacting I.D. and O.D. tolerances as well as a dense I.D. surface finish.

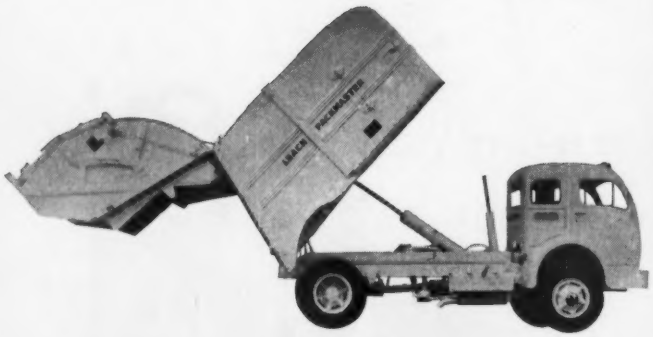
Standard I.D. tolerances are closer than those shown for tubing made by other processes. When necessary, tolerances can be maintained to 50% closer than standard.

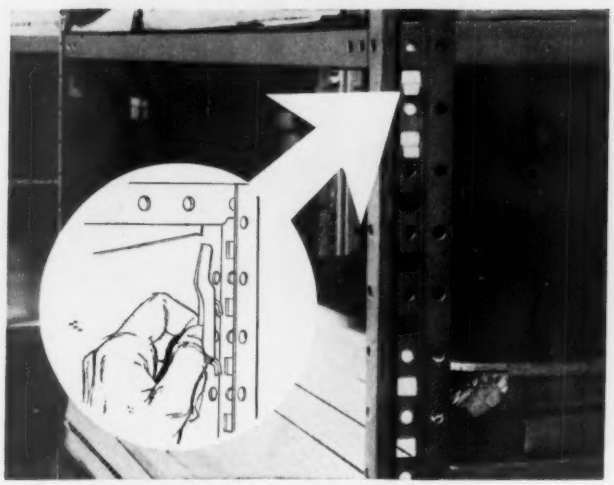
For full information on Republic ELECTRUNITE Special Smooth I.D. Hydraulic Cylinder Tubing, Republic Hydraulic Fluid Line and Mechanical Tubing contact your Republic representative or write direct.

Strong, Modern, Dependable

Steel

COLD FINISHED ALLOY BARS form high strength pins to carry the full weight (up to 5 tons) of this Packmaster body and its refuse load when unit is hoisted to unload. Republic Cold Finished Alloy Bars, cut off, drilled, and chamfered by Leach Company, Oshkosh, Wisconsin, manufacturers of the Packmaster, offer the toughness and abrasion resistance necessary in this application. Investigate the advantages of using Republic Cold Finished Alloy Bars for your component parts production. Mail coupon.





REPUBLIC CLIP SHELVING saves valuable floor space. Complete line includes shelves, parts, accessories, and related items. Every piece is Bonderized. Erection is quick and easy, no tools needed. Adjustable arrangements meet changing shelving needs. Let your Republic representative solve your shelving problems. Write for information.

REPUBLIC "KNOW-HOW" solves your fabrication problems. Contract manufacturing is a full-time operation at Republic's Berger Division. Engineers work with you in developing your product, in solving manufacturing, assembly, delivery problems. Well-rounded stock of tools, dies, complete machine shop. Modern production lines for shearing, punching, forming, painting. Call, or write today.

REPUBLIC STEEL

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

CIRCLE 266 READER SERVICE CARD

REPUBLIC STEEL CORPORATION
DEPT. AM-2501
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on the following products:

- ☐ ELECTRUNITE® Special Smooth I.D. Hydraulic Cylinder Tubing
- ☐ Republic Cold Finished Alloy Bars
- ☐ Republic Clip Shelving
- ☐ Republic Contract Facilities

Name_____ Title_____

Company_____

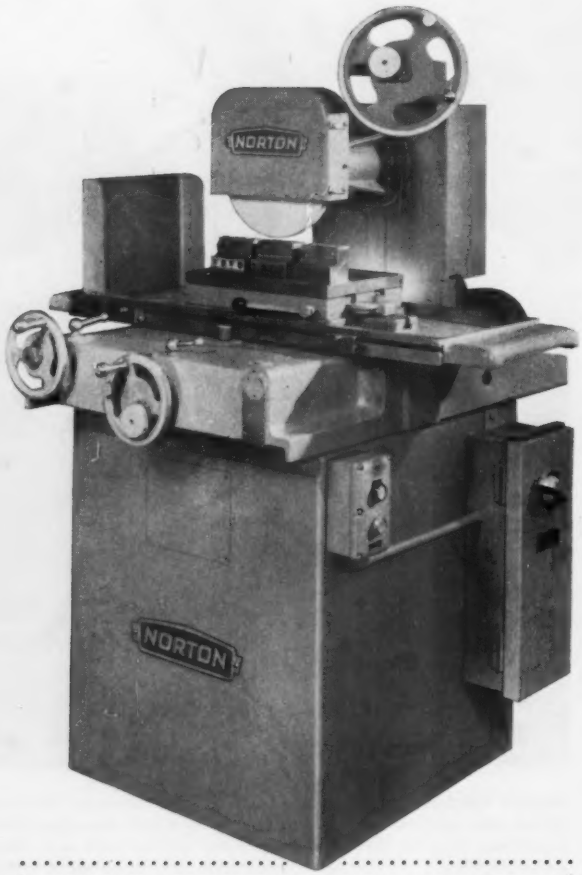
Address_____

City_____ Zone____ State_____

Announcing

New Norton Hand

NORTON 6 x 12" Type TS Hand Surface Grinder Table travel up to 14". Cross traverse up to 7". Maximum height capacity 12½"*. Grinding wheel, 7" x ¾" x 1¼". Table traverse by hand through positive cable drive. One revolution of hand wheel moves table 6⅝", on friction-free ways.



NORTON 10 x 16" Type TS Hand Surface Grinder Table travel up to 18", cross traverse to 11", grinding wheel 12" dia. Extended wheel head ways assure maximum grinding support and full use of 12" vertical* capacity. Two-speed wheel drive. Fine cross-feed increments of .0005".

*Table top to bottom of full size grinding wheel.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Surface Grinders....

Latest Norton developments...
simplified, rugged, versatile...
are welcome cost-cutters
for your daily toolroom jobs.

Like all Norton grinders — from highly complicated automatic production machines to simpler toolroom types — the new TS Type Hand Surface Grinders have the common denominator of *precision performance, easy operation* and *long service life,* built into them as follows:

Precision Performance. Two-speed wheel feed hand wheel has graduations of .0005" for fast, accurate positioning, plus a vernier scale graduated .0001" for precise grinding feeds. Rigid and long vertical slide and saddle design provide maximum support for moving parts, resulting in reduced vibration and better finish. Accuracy of center-guide cross feed is excellent for groove and shoulder grinding.

Easy Operation. Controls are at working height, for fatigue-free table and cross feed operation. Antifriction bearings under the table produce a smooth and easy motion for reduced effort. Table and cross slide controlled by hand wheels with no levers requiring crossed-arm operation when motions are simultaneous. These grinders are the only machines of their type with hinged wheel guard for quick wheel change.

Long Life. Anti-friction spindle is mounted in housing for rigid, rugged strength. Long vertical slide ways eliminate wheel "hang up" tendencies and provide large way areas. Deep saddle eliminates rocking, gives strong support for grind. Antifriction rollers cut wear on table and cross slide.

Over-all economy of NORTON TS Hand Surface Grinders is strengthened by many features such as their uncomplicated, accessible mechanisms and clean, uncluttered design which reduce maintenance costs. For details on how these new NORTON developments can cut your own daily grinding costs, see your Norton Man, a Trained Grinding Engineer. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Chicago, Detroit, Cleveland.

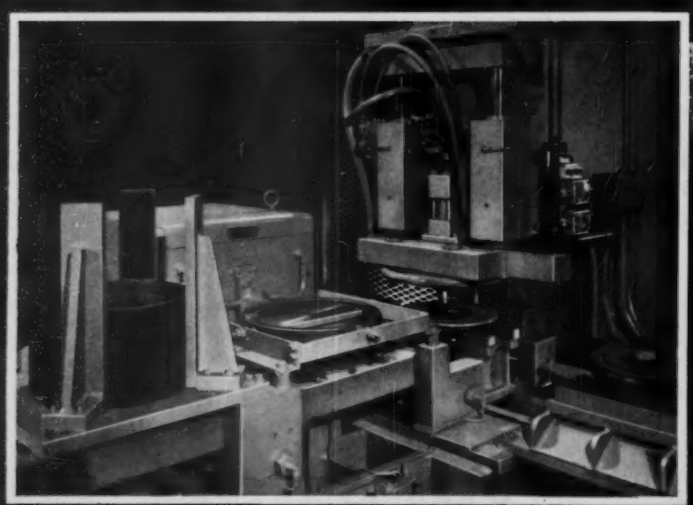
In Canada: J. H. Ryder Machinery Co., Ltd.. Toronto 5.

NORTON
MACHINE TOOLS

75 years of . . . **Making better products . . . to make your products better**

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

In Section I, tool slide units pivot to a convenient position for ready access to cutting tools.



The ring gears, stacked at the left, are heated in an induction coil in the center, pressed on the flywheel at the right and shrunk in position by a cold air blast.

Another Automation First by Cross

Transfer-matic Completely Processes Flywheels and Assembles Ring Gears

Machining Operations Include Facing, Turning, Boring, Chamfering, Drilling and Tapping

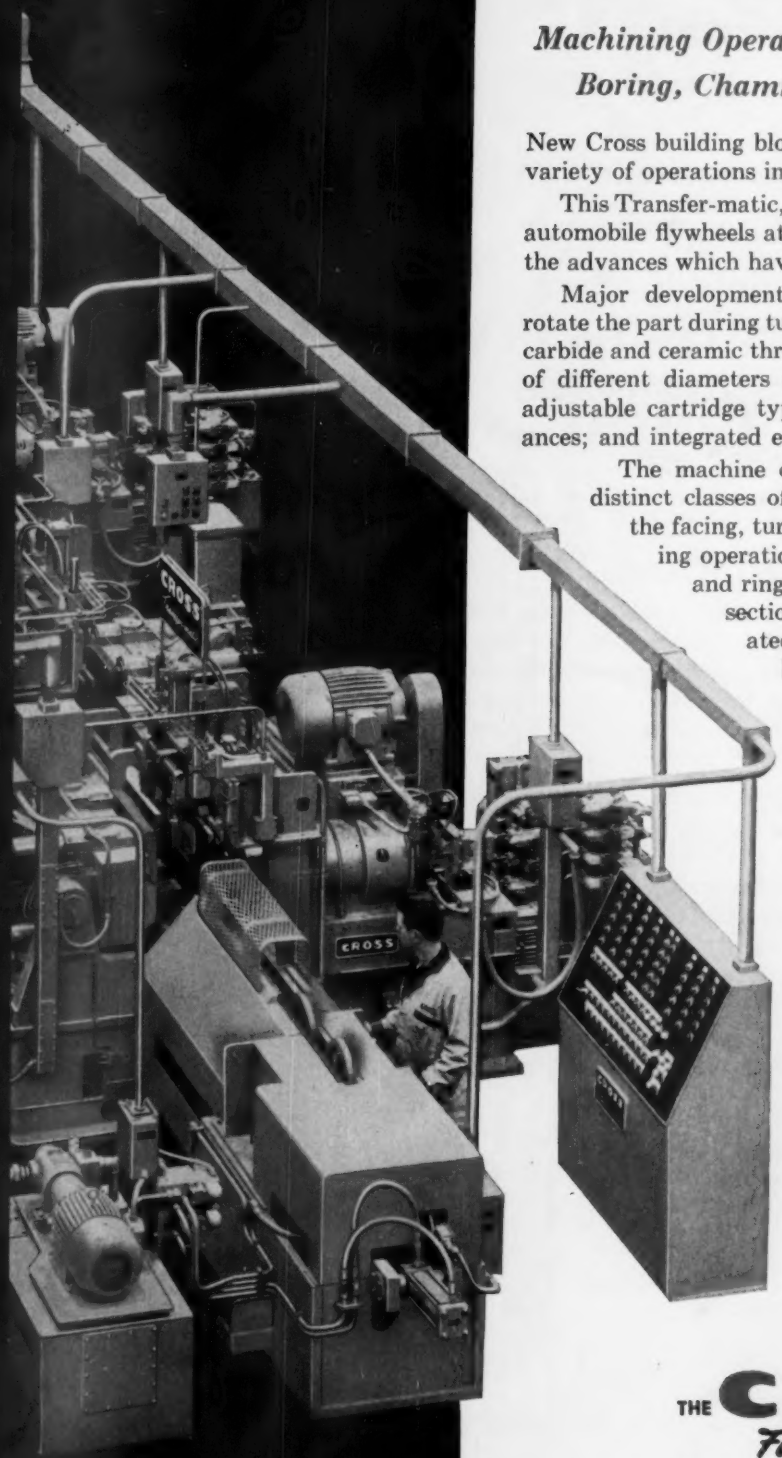
New Cross building blocks make it possible to complete a wide variety of operations in addition to drilling and boring.

This Transfer-matic, which completely processes two different automobile flywheels at the rate of 132 per hour, is evidence of the advances which have been made.

Major developments include standard chucking units to rotate the part during turning, facing, and boring; the use of both carbide and ceramic throw-away inserts to assure proper cutting of different diameters at a single spindle speed; individually adjustable cartridge type tool holders to maintain close tolerances; and integrated equipment to assemble the ring gear.

The machine consists of two sections to handle two distinct classes of operations. The first section performs the facing, turning, boring, undercutting and chamfering operations. Drilling, reaming, tapping, cleaning and ring gear assembly take place in the second section. The two sections are normally operated as one machine. A banking station between sections permits either to continue when the other is stopped for tool changes.

Quick changeover for the two flywheel designs is achieved by such features as the use of eccentric spindles to machine different hole patterns.



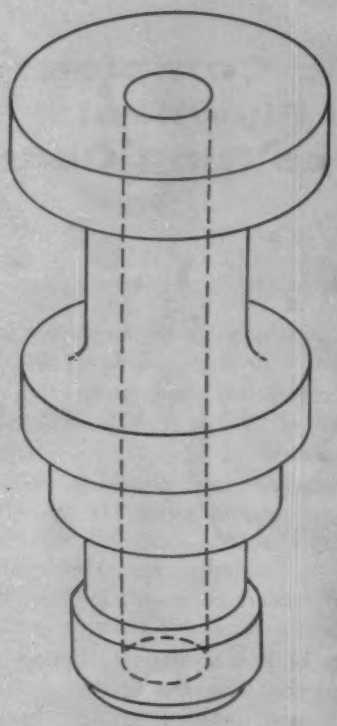
Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

CIRCLE 270 READER SERVICE CARD



Internal Broaching?

Here's maximum efficiency... the hole in this CLUSTER GEAR blank

LAPOINTE -BROACHED

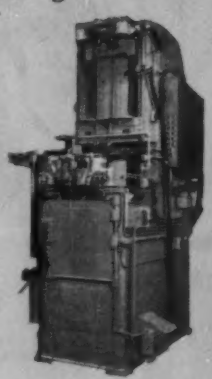
at 160 parts per hour!

Specially tooled for this part, and broaching close-tolerance holes in *two gears at each cycle* of the machine, the broaching time averages less than 23 seconds per hole, operating at 80% efficiency. The loading fixture had to be at floor level because the machine could not be pitted, and the operator of the previous machine attended this one, which required loading only.

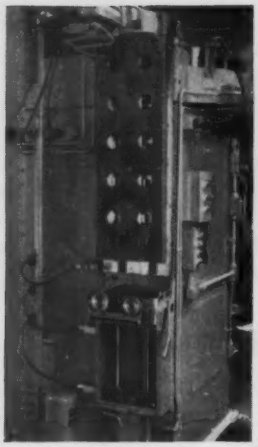
For broaching holes and other internal contours, Lapointe Vertical Pull-Down Broaching Machines are available in a series of 8 standard sizes, ranging from 5-ton, 36-inch stroke to 50-ton, 72-inch stroke. Special features can of course be built into any of these machines, to accommodate your particular requirements. We suggest that you invite a qualified Lapointe Field Engineer to show you how to cut production time and improve your surface finish by Lapointe-Broaching.

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire

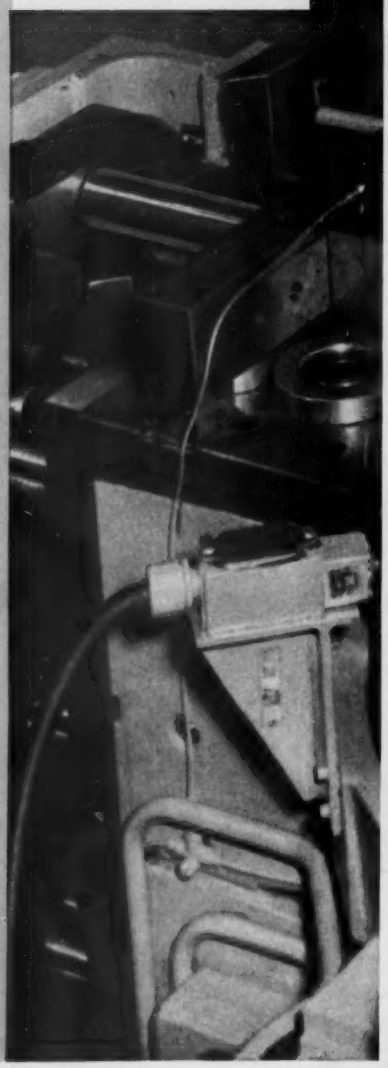
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

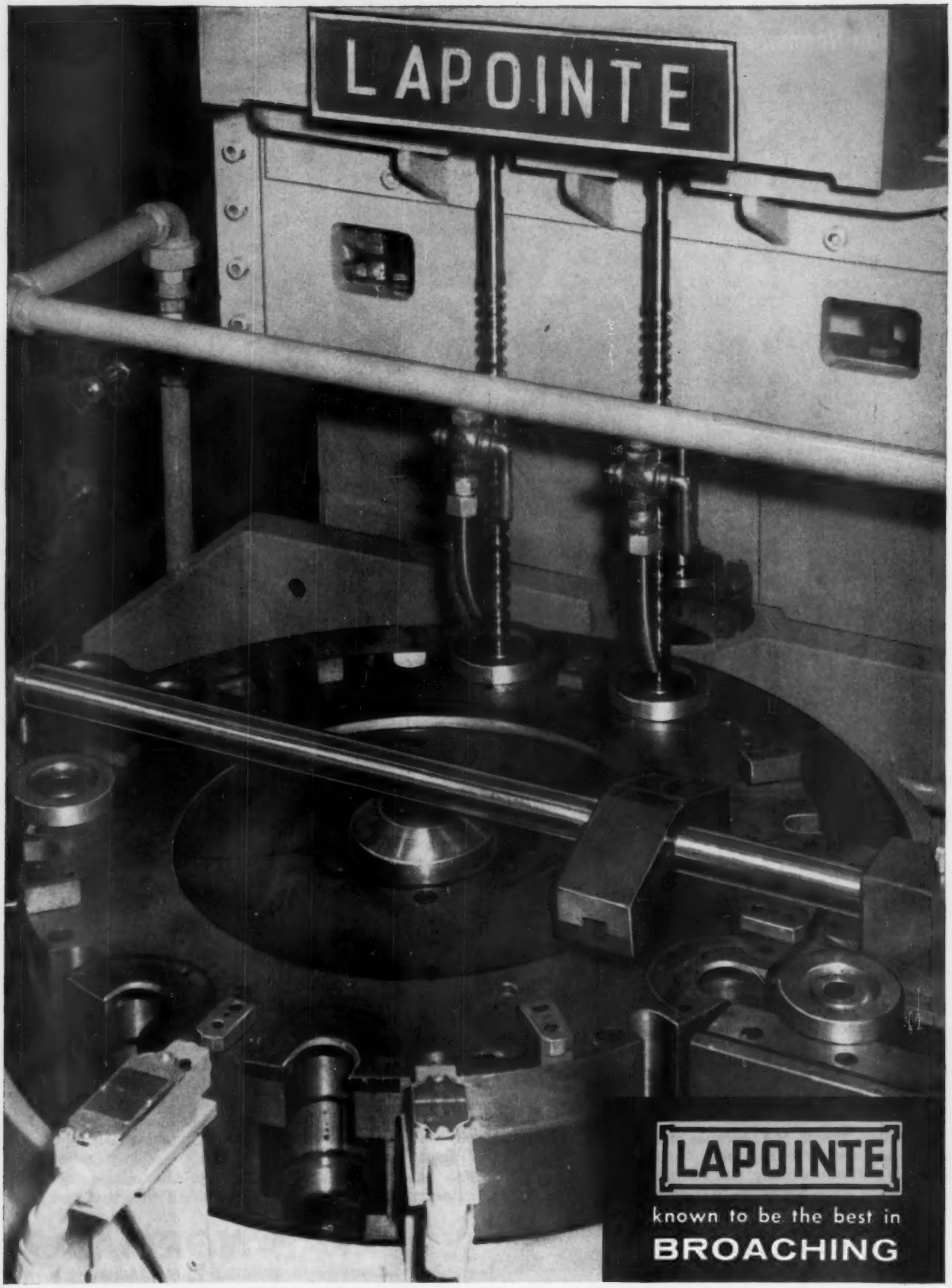


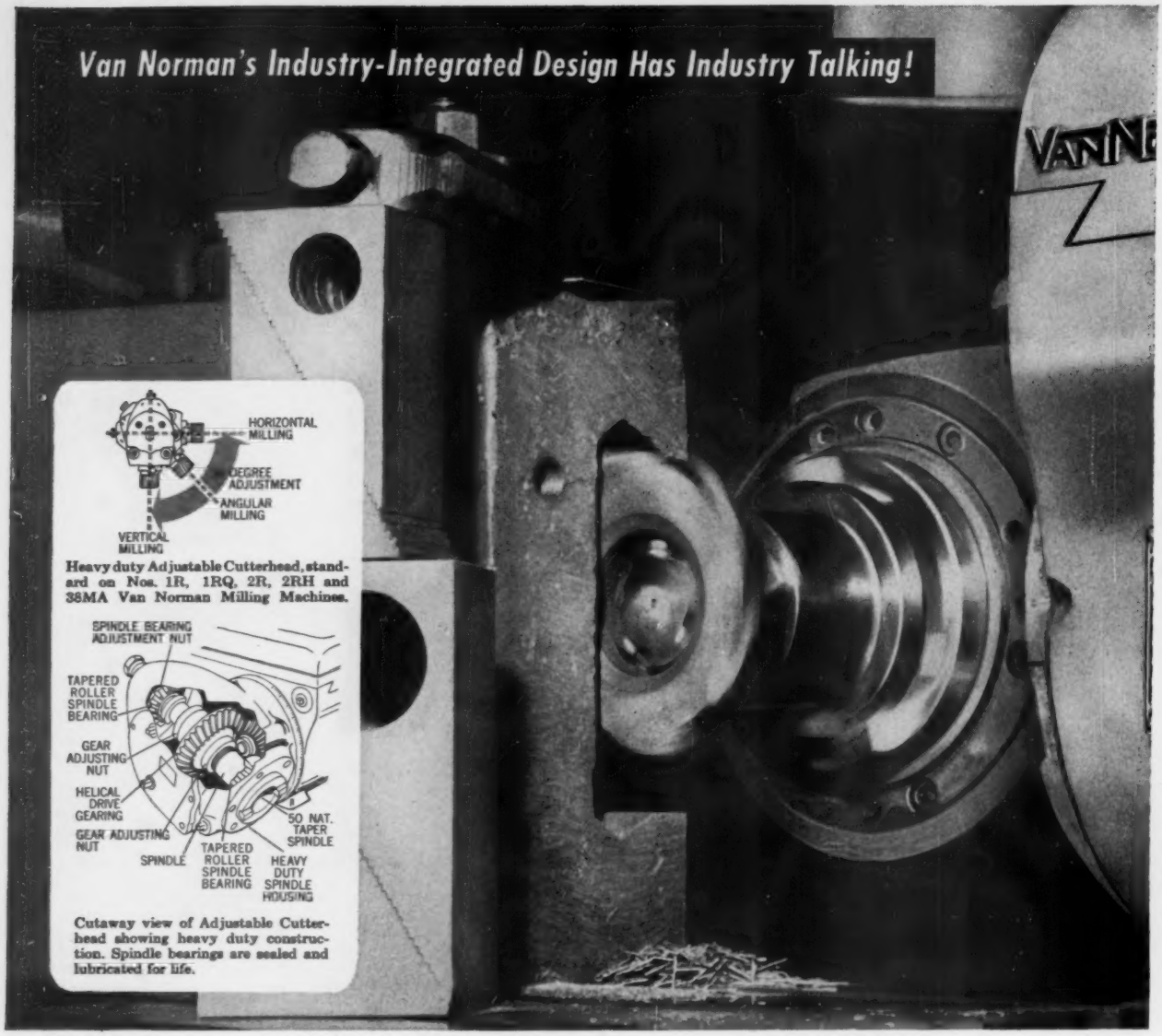
Lapointe V-3 15-Ton, 48-inch stroke Hydraulic Pull-Down Broaching Machine



Elevating Automatic Feed Fixture Lapointe-engineered and built, to carry two gear blanks side-by-side up to the 2-station rotary broaching fixture on the machine (see large picture at right). Note the broaches leaving the follow-through of retriever.




LAPOINTE
LAPOINTE
known to be the best in
BROACHING


Van Norman's Industry-Integrated Design Has Industry Talking!
HORIZONTAL MILLING
90 DEGREE ADJUSTMENT
ANGULAR MILLING
VERTICAL MILLING
Heavy duty Adjustable Cutterhead, standard on Nos. 1R, 1RQ, 2R, 2RH and 38MA Van Norman Milling Machines.
SPINDLE BEARING ADJUSTMENT NUT
TAPERED ROLLER SPINDLE BEARING
GEAR ADJUSTING NUT
HELICAL DRIVE GEARING
GEAR ADJUSTING NUT
SPINDLE
TAPERED ROLLER SPINDLE BEARING
HEAVY DUTY SPINDLE HOUSING
50 NAT. TAPER SPINDLE
Cutaway view of Adjustable Cutterhead showing heavy duty construction. Spindle bearings are sealed and lubricated for life.

VAN NORMAN RAM-TYPE MILLER SLASHES ...SAVES TIME—WILL PAY FOR

Adjustable Cutterhead Dovetails and Machines Component Parts—

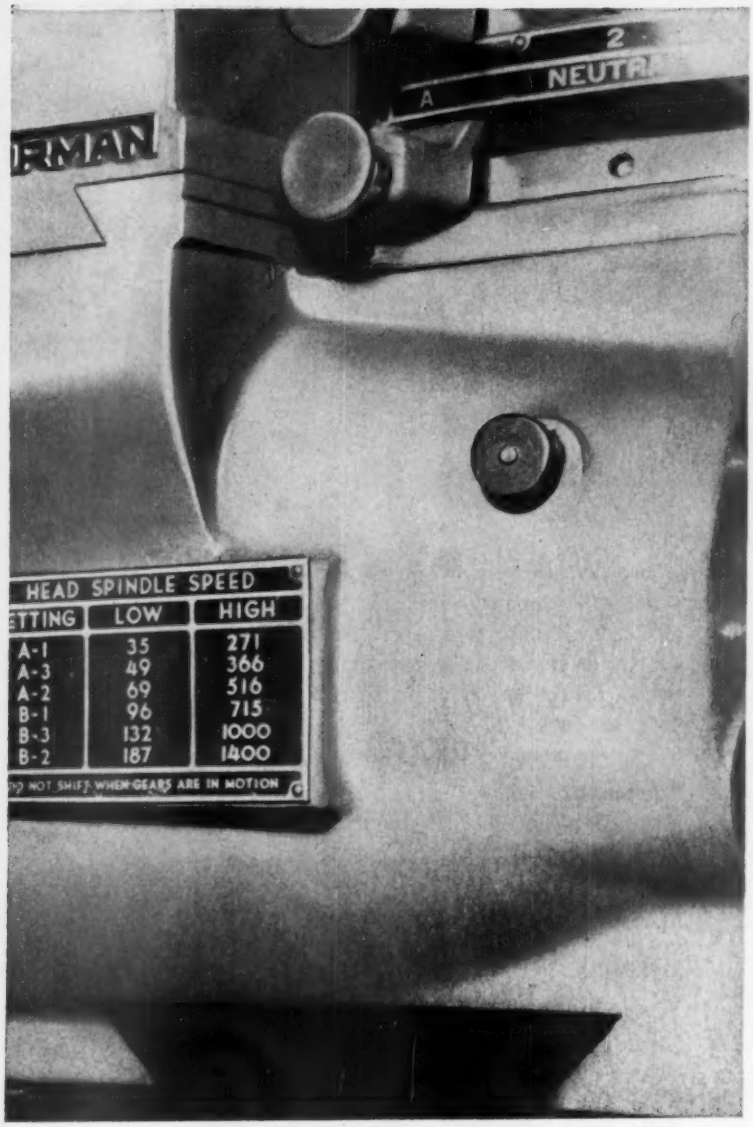
A large metalworking manufacturer cut component part production 15% when they bought a VN 38 MA Ram-Type Miller. This low-priced, low-maintenance miller replaced three machines formerly needed to get accuracy in the finished work.

In addition, the 38 MA, because of tremendous range capability, also serves as a jack-of-all trades around the shop. It performs drilling, slot milling, slab milling and face milling while machining to tolerances of .001".

Adjustable Cutterhead Solves Problem—The VN 38 MA features a swivel cutterhead that can be set in horizontal, vertical and any angular location within a 90° angle—locks in position on the ram to guarantee precise cuts within the entire 29" ram range. Full horse power is delivered to spindle *in any position* for maximum cutting efficiency.

With the ram-cutterhead assembly, the company's three-step milling job is finished in half the previous

VAN NORMAN
SPRINGFIELD 7, MASSACHUSETTS



PRODUCTION COSTS 15% ITSELF IN 3 YEARS

Spindles...Flanges...Castings

time—and they expect the 38 MA to pay for itself in three years.

Greater Accuracy . . . Less Downtime—The VN 38 MA is specifically engineered to produce more—better . . . at less cost. The addition of a backlash eliminator controls table feed under all conditions.

Get the Complete Facts—Your VN franchised dealer is ready to show you how a VN milling machine can cut costs and speed production in your shop. Call him today.

MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

Another typical Van Norman milling machine cost-saving application

A leading manufacturer and fabricator of industrial plastics, wanted speed of production, versatility, and accuracy in a milling machine.

They found this with Van Norman . . . as demonstrated when they ordered seven *additional* VN Milling Machines after they achieved such out-standing results with the first—production speeding results that paid off in cold cash.

Production Time Cut 25% to 30%—With the new VN Milling Machine, the company cut production time 25% to 30% . . . an enormous cost factor. Moreover, the VN Milling Machine gave more varied production . . . was easily adaptable for a wide range of jobs. And gave more accurate, unsupervised production.

Once set, the VN Milling Machine ran indefinitely on a particular job without rechecking . . . and delivered the same precision and fine tolerance on the last piece milled as it did on the first. 4232

DODGE HAS MORE PROVED BEARINGS THAN YOU HAVE BEARING PROBLEMS!

It pays to buy from a line of stock bearings—bearings that have been proved in thousands of installations similar to yours. You benefit by getting known dependability; and you get the important savings of high quality at production price.

PIN-POINT SELECTIVITY

Dodge has supplied mounted bearings to industry for over three-quarters of a century. Dodge bearings have always kept pace with improved production practices. Each new condition of service has been met by Dodge as it has arisen, with the result that the Dodge line contains mounted bearings to meet almost every service requirement with pinpoint accuracy.

High load, high speed, excessive dust, moisture, corrosion, high or low temperatures, continuous operation—you name it!—such conditions and their combinations are met every day with Dodge bearings.

BROAD LINE—WIDELY DISTRIBUTED

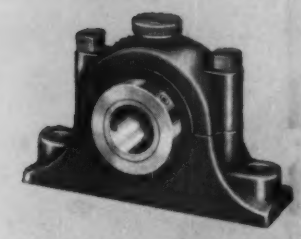
In the great variety of mounted bearings developed by Dodge, you will most likely find the precise unit to fit your requirements ideally—without paying for features you do not need. And if your requirements call for several types of bearings, there is an advantage in having them of common design, such as Dodge offers.

The Dodge line is probably broader than any other line of mounted bearings in America. And of special importance to machinery manufacturers, it is the most widely distributed line. There is always a Dodge bearing of the right type and size near at hand.

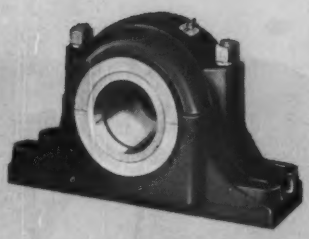
You can check this with your local Dodge Distributor. Ask him—or write us for the Dodge Bearing Bulletin.

In addition to tapered roller, spherical roller and ball bearings, Dodge builds many types of sleeve bearings. Here is the "large and small" of the sleeve type bearings carried in stock—ranging from an 8-in. Sleevoil weighing over 1200 lbs. to a ½-in. solid journal bearing weighing 9 ounces.

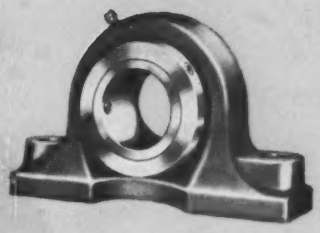
DODGE MANUFACTURING CORPORATION, 100 Union Street, Mishawaka, Indiana



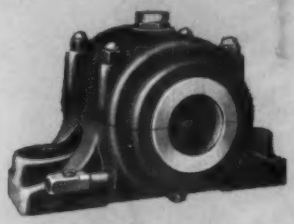
DODGE PILLOW BLOCKS WITH TIMKEN TAPERED ROLLER BEARINGS



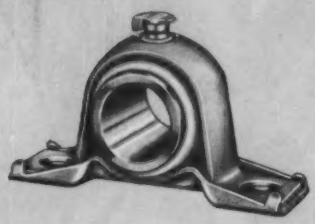
DODGE SPHER-ALIGN PILLOW BLOCKS WITH SPHERICAL ROLLER BEARINGS



DODGE BALL BEARING PILLOW BLOCKS

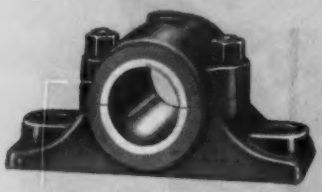


DODGE SLEEVOIL PILLOW BLOCKS

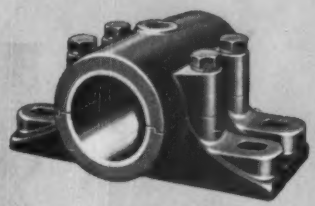


DODGE BRONZOIL PILLOW BLOCKS

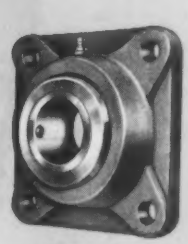
DODGE BRONZE BUSHED PILLOW BLOCKS



DODGE JOURNAL BEARINGS SOLID AND SPLIT



DODGE HEAVY RIGID PILLOW BLOCKS



FLANGE BEARINGS: HANGER BEARINGS: BEARING UNITS: TAKE-UPS

● **Dodge Pillow Blocks with Timken Tapered Roller Bearings.** America's quality pillow blocks. Assembled, lubricated, adjusted and sealed at the factory. 5 types for varying needs.

● **Dodge Spher-Align with Spherical Roller Bearings.** Rugged heavy duty, compact, inherently self-aligning. Exclusive Micro-Mount simplifies installation.

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● **Dodge Sleevoil Pillow Blocks.** Ultra quality . . . extra long life . . . accessibility . . . *quiet*. Plain or water-cooled.

● **Dodge Bronzoil Pillow Blocks.** Efficient, low cost pillow blocks with self-oiling, capillary bronze bushings. Self-aligning. Large oil reservoirs.

● **Dodge Bronze Bushed Pillow Blocks.** Quiet fan and blower pillow blocks with two bronze bushings of high lead content mounted in one cast iron housing.

● **Dodge Journal Bearings — Solid and Split.** True running, dependable. Babbitted bearings with precision machined bores and faces. Finished bases.

● **Dodge Heavy Rigid Pillow Blocks.** Rugged, carefully bored, babbitted pillow blocks for many applications requiring grease lubrication. Finished bases and ends.

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DODGE

of Mishawaka, Ind.

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IS TO START WITH AN ALCO FABRICATED GEAR-BLANK LIKE THIS

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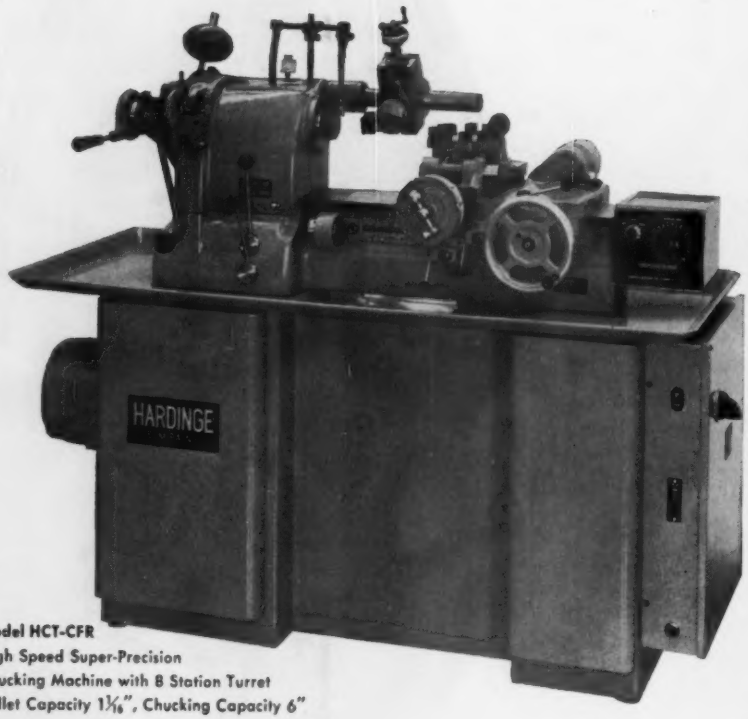
MODEL HCT-CFR

The Model HCT Chucking Machine can finish diameters, shoulders, and end faces, and cut precision threads in one setting—all concentric with each other. Adjustable, exact cutting positions produce closer tolerance parts on a production basis. It assures tool room accuracy and low part cost.



Model HCT-CFR
High Speed Super-Precision
Chucking Machine with 8 Station Turret
Collet Capacity 1 1/16", Chucking Capacity 6"

Model DSM59
High Speed Super-Precision
Second Operation Machine—Collet Capacity 1 1/16"

MODEL DSM59

This time-tested production machine is easy to set up and enables relatively inexperienced operators to turn out parts rapidly within close tolerances and to fine finish. Operations on this machine reduce expensive tooling, upkeep, and down time of automatics.

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

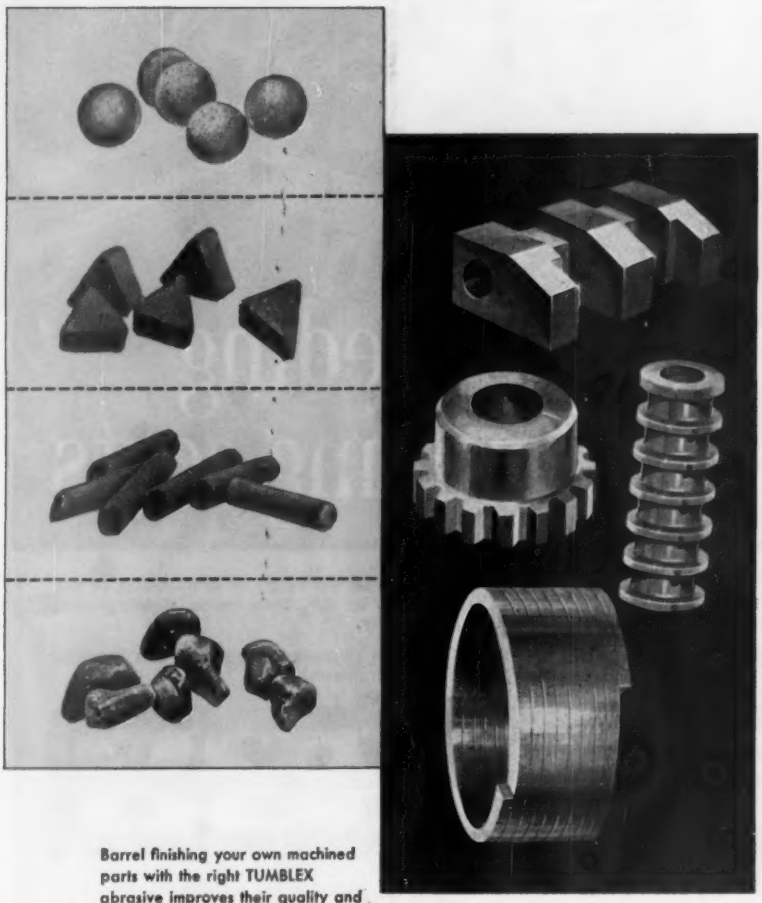
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Barrel-finishing is best finishing

to cut costs of your machine parts

It's common knowledge that barrel-finishing is now the one outstanding way to cut costs and improve the appearance of mass-produced parts.

If you're missing these production advantages because you've felt your own particular machined parts may be too delicate and complicated . . . too big and heavy . . . or not the right material . . . this message is for *you!*



Barrel finishing your own machined parts with the right TUMBLEX abrasive improves their quality and appearance. And this faster finishing can cut your cost-per-piece produced.

The fact is that barrel-finishing with Norton TUMBLEX* abrasives is your surest, quickest way to remove burrs, provide uniform radii, improve surface finish and increase the fatigue strength of the parts *you* are machining.

The variety of materials, sizes and shapes covered is practically unlimited. Materials include ferrous, non-ferrous, and modern space alloy metals — also plastics and many other non-metallics. In sizes, anything from tiny roller bearings to aircraft wing spars can be handled. And shapes can be the most complicated ever processed.

For your product's eye-appeal, barrel-finishing provides excellent finish. Lower handling costs are assured by the barrel-finishing ability to combine several operations — deburring, breaking sharp edges, surface finish refinement, etc. — at the same time. In addition, your barrel-finished machined parts can be plated without burnishing or buffing — and welded or brazed after simple cleaning.

Get complete proof. Send sample parts to our Sample Processing Department. We'll barrel-finish, return samples and report the methods and abrasives you need for new production advantages. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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Making better products . . . to make your products better

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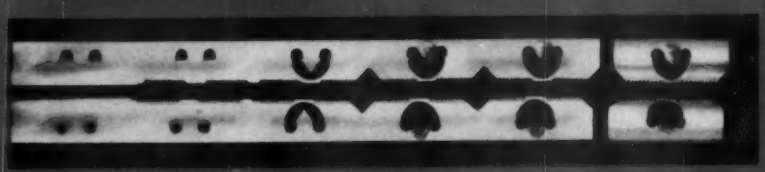
multiple feeding cuts stamping costs

Coil stock of regular and irregular profile can be fed singly or in multiples of two or more strips, accurately and at high speeds by U.S. Slide Feeds. Metal, plastic, wire, paper and fibre are fed with equal facility.

G. & A. Machine Works, New York, N. Y. has produced more than one hundred million webbing clips with the U.S. Slide Feed illustrated.



Two strips of 19 gauge cold rolled steel, ¾" wide are fed simultaneously into a 6 station scrapless die. Pilots are not used. A Model 68-A, U.S. Slide Feed and Stock Drag, arranged for multiple feeding produces 120,000 perfect parts per 8 hour day.

Send us specifications of the parts you are now running, or considering. Our developments in press feeding equipment and techniques may provide a means to important savings. Your inquiries will receive prompt attention.

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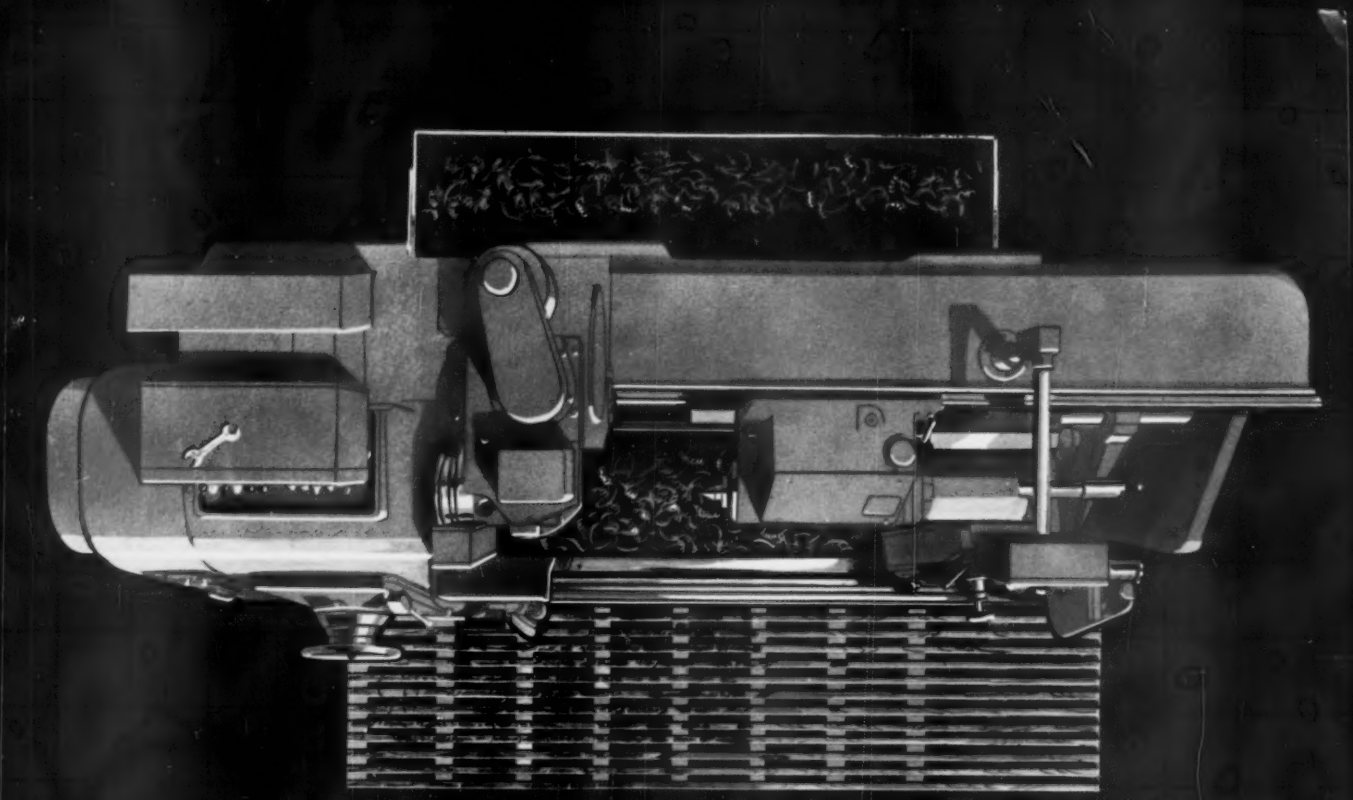


You can turn a profit on a New Britain +GF+ Copying Lathe

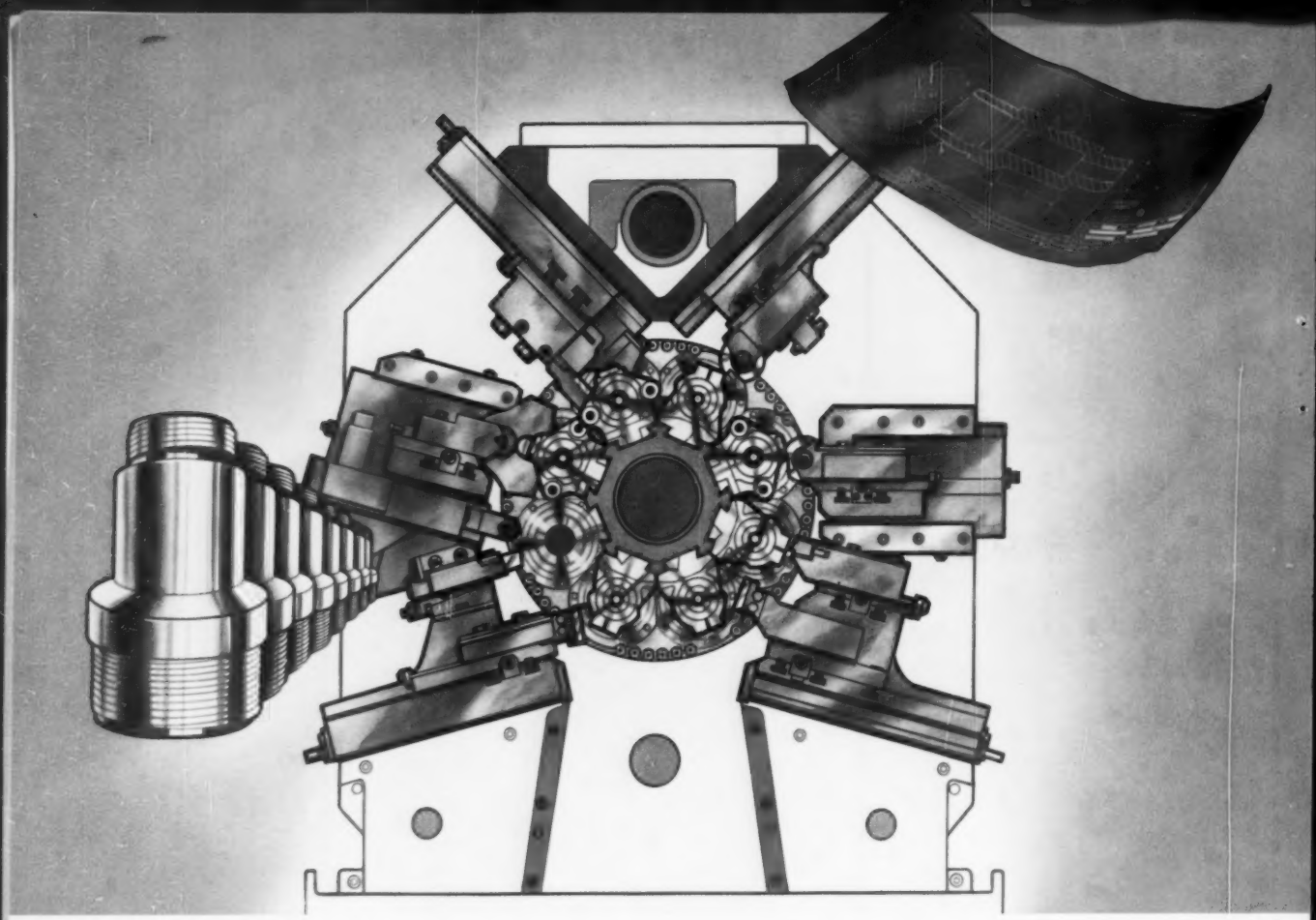
Here's a birdseye view of a New Britain **+GF+** Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain **+GF+** is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain **+GF+** is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the **+GF+** are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut



Unlimited tooling combinations with New Britain Bar Machines

Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to 2⅝" and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

This well-known manufacturer depends on . . .

A BANK OF THOMPSON GRINDERS

. . . for a tough production job.

THOMPSON RAMO WOOLDRIDGE INC. picks Thompson Grinders for accuracy, dependability and speed.

All the Thompson machines shown above in one bank are grinding jet aircraft engine compressor vanes. Each of the 5 surfaces on the root end as well as the concave and convex airfoil surfaces on the lug end are ground to extreme accuracy on the stainless steel forgings.

For the five years that these Thompson machines have been steadily on this job, downtime and maintenance costs have been negligible factors.

Put your toughest production job on a Thompson grinder and watch it cut your costs, speed your production and improve your product.

THE THOMPSON GRINDER CO. Springfield, Ohio

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

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WHY DO THEY COME . . . these important industrial leaders from all over the world? They come because they are interested in finding better ways of doing things. These men must find solutions to problems raised by the need for increased accuracy

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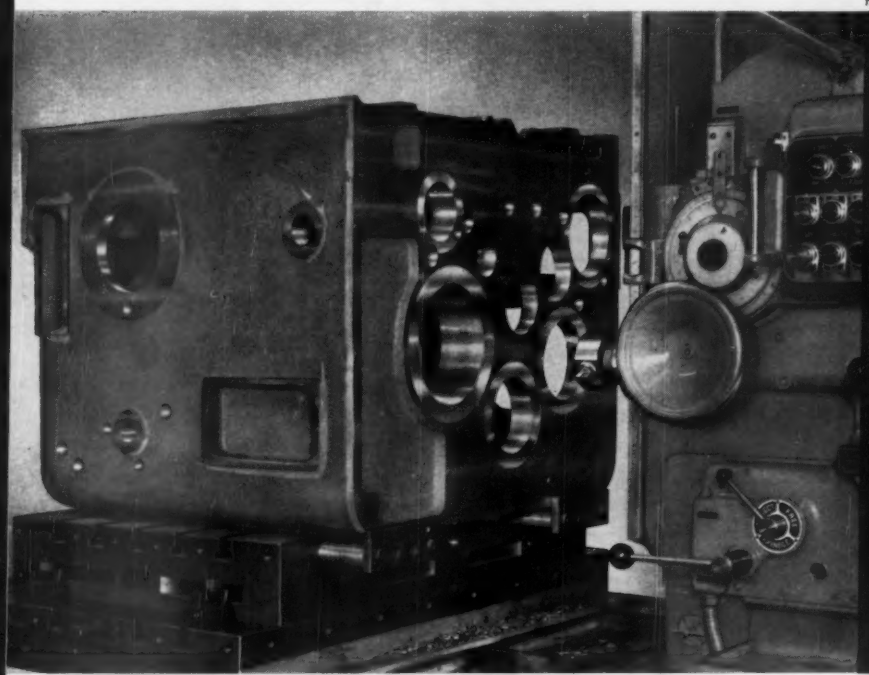

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- The Micropoint Tool Grinder
- The Microbore System of Precision Tooling

Lathe headstock rough and finish milled and bored from four sides in one setup on a 3B-48 JIGMIL. Total machining time is approximately 8 hours.

and higher productivity with readily available skills. Specifically, in the field of boring and milling, they've heard that the JIGMIL Technique and the DeVlieg concept of Precision Machining go a long way towards solving such problems. No one is ever disappointed. Every visitor, whether from overseas or local firms, is introduced to rewarding new concepts in machining. Concepts that once discovered, cannot be ignored.

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ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

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UP TO 5-8 TIMES THE WEARLIFE OVER TAPERLOCK PLUGS BY REVERSING AND/OR CUTTING OFF WORN ENDS.

WALSH 65-Ton Deep Throat Punch Press with Variable Speed Drive Automatic Lubrication Air-Cushion. All presses "run-in" with Molykote at the factory.

CHAMPION Two-Stage Automatic Horizontal Compress OEH 38- with Exclusive OIL MONITOR (low oil lev safety contro

Let our years of experience in the fields of production and precision prove beneficial to you and your products. Write or phone these firms for complete information about their important new products and services. In addition, all offer free engineering consultation services. No obligation, of course.

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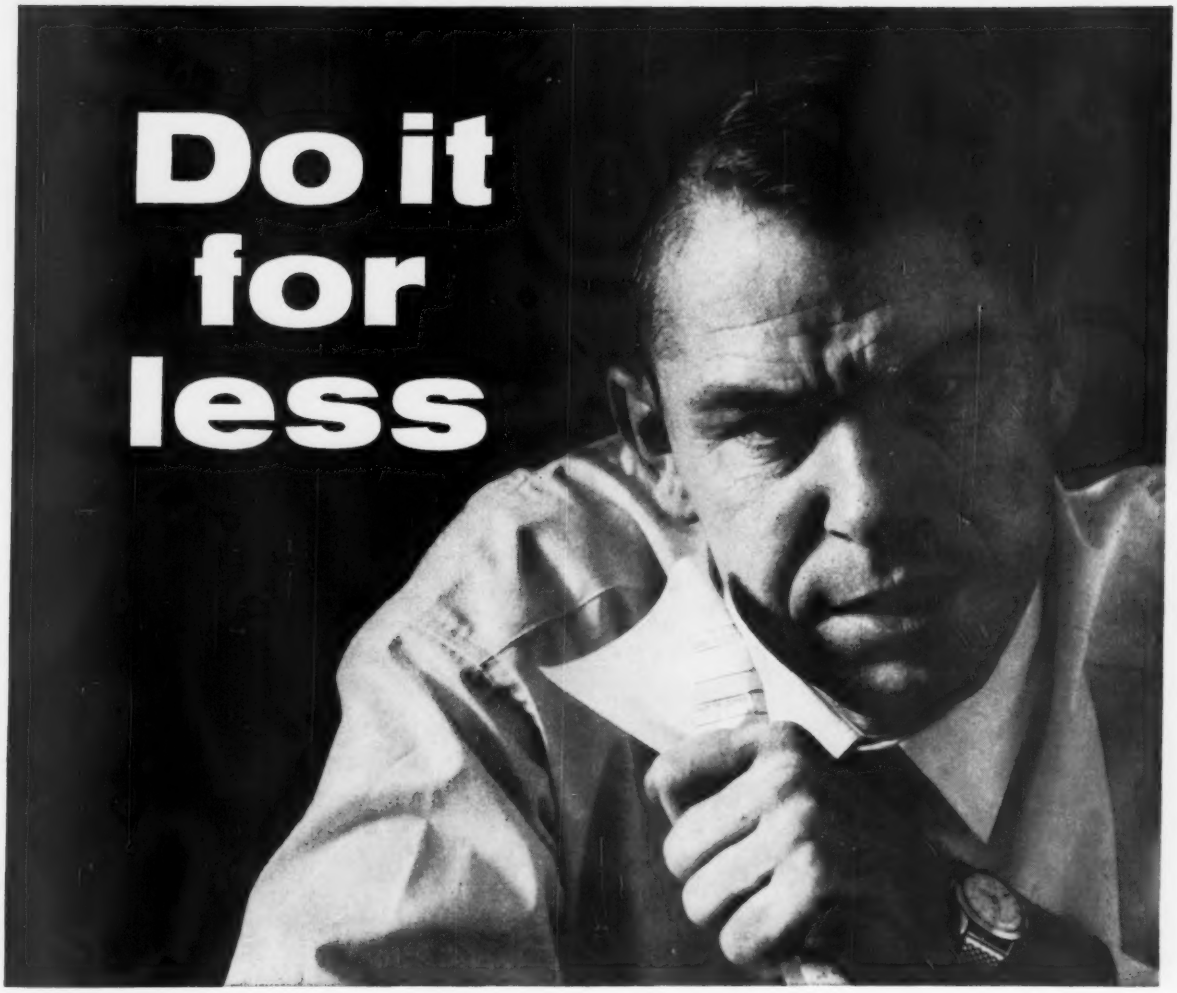
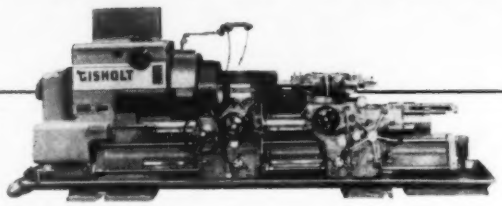


ON A GISHOLT SADDLE TYPE TURRET LATHE



Gisholt MASTERLINE 3L
Saddle Type Turret Lathe

Offers Maximum Operator Ease.

Speed selector for 12 or 24 spindle speeds.

Separate lever controls for cross and longitudinal rapid traverse.

With cross-feeding hex turret, standard tools handle all types of machining.

JETracer (for cross slide, cross-feeding hex turret, or mounted on turret face) handles tapers, contours, steps and combination forms automatically.

Call your Gisholt Representative or write for literature.

This man has just lost an order because his turret lathes couldn't compete. Yet, they are *only* ten years old . . . as are over 65% of the machines in use today.

With all the talk about tape control, it's easy to forget that even the standard turret lathe has changed. It's 40% more efficient than it was ten years ago. Many skilled manual operations can now be done automatically. *You* could rely on *fewer* machines and save time, floor space, reduce tooling and maintenance costs, and skilled labor requirements!

If you have ten-year-old's in your shop, it's time to act. Find out what the new Gisholt Turret Lathes can do for you.

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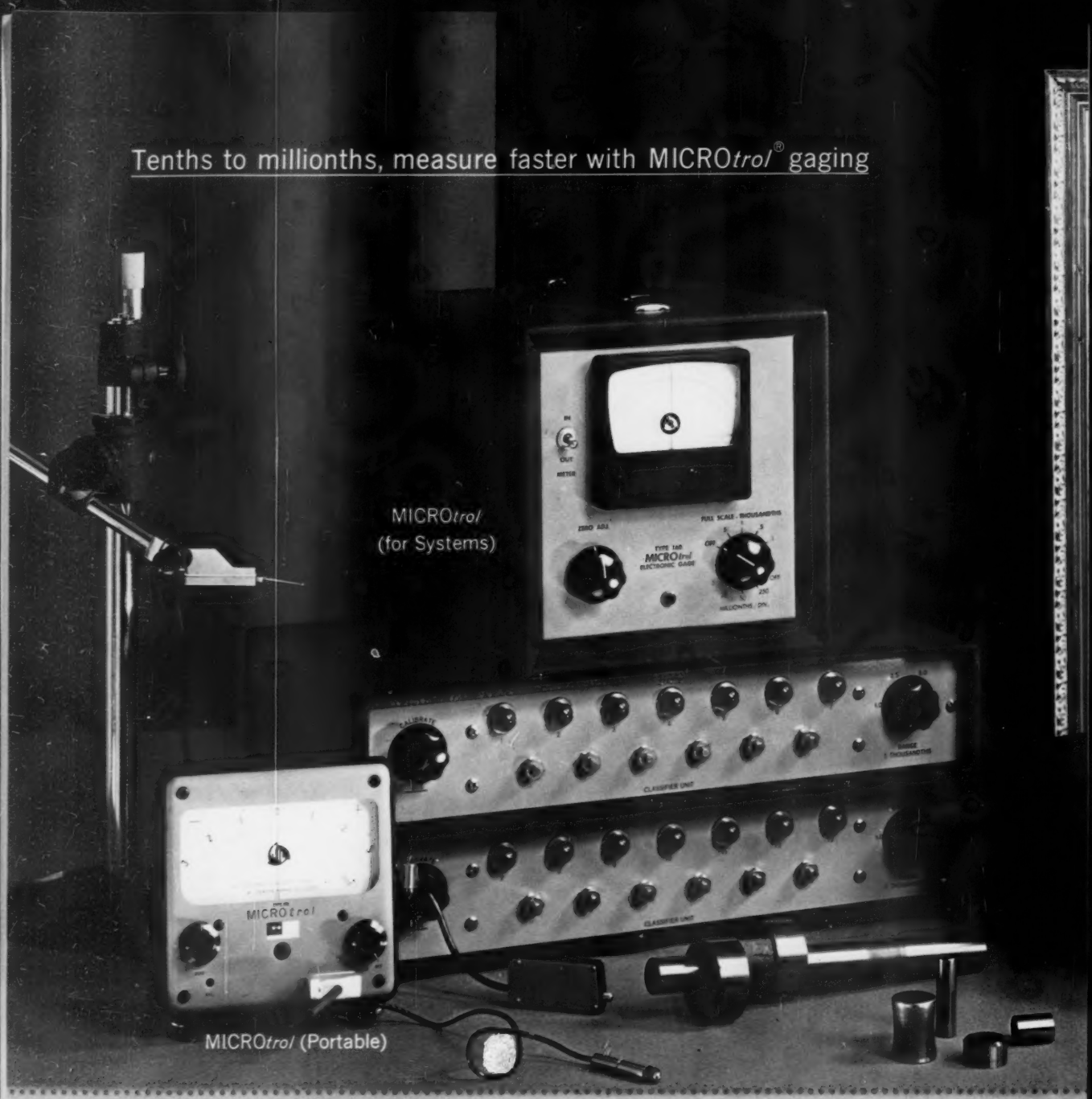
Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

◄ CIRCLE 287 READER SERVIC CARD

CIRCLE 288 READER SERVICE CARD ▲

CIRCLE 289 READER SERVICE CARD ►

Tenths to millionths, measure faster with MICRO*trol*® gaging



Lightweight, transistorized; battery or ac powered, MICRO*trol* Type 170

Use this fast, accurate gage at the machine, in production, in inspection, in the laboratory.

It's rugged and lightweight because it's transistorized. Four interchangeable gage heads readily cover the whole range of normal gaging setups.

FEATURES: Weight only 3 lbs. Easy to operate; just 2 knobs. Two dual range models: ± .0003 to ± .003; or ± .001 to ± .010. Pocket sized. Accurate. Basic gages from $341.

Your first step to automatic quality control of machine tool production is MICRO*trol* Type 160

With this complete family of electronic equipment you can range from fast and accurate measurement of dimensions on the bench to complete control of manufacturing in the plant.

With accessories you can get automatic inspection, automatic sorting, or complete closed-loop control.

FEATURES: 4 scale ranges available. Repeatability to 0.000005". High stability and reliability. Comparator systems from $764.

Now with new motor drive Transistorized METRO*surf* Type 180 measures surface roughness at less cost

METRO*surf* is the low-cost, high accuracy way to end the hazards of measuring surface roughness by touch or sight.

It's fast. It's portable. You can use it at machine or bench. Battery or ac models available.

FEATURES: 5 range selections; 3 to 300 microinches full scale. Big dial. Motor-driven or hand-held tracer. Amplifier and tracer head, $495.

CONTROL
CUTLER-HAMMER
AIL DIVISION

These Cutler-Hammer systems and gages hold metalworking to precise tolerances AUTOMATICALLY

To reduce inspection time and cost, Cutler-Hammer supplies the precision metalworking industry a range of gaging and control devices whose building block concept provides great versatility.

You can start with a MICRO*trol* gage or an INCHWORM motor. Then or later, you can add from a choice of accessories. These allow you to inspect, sort, reject, record quality . . . correct machine tools and stop them from making scrap . . . *completely automatically.*

These gages and systems are products of a company that's a leader in advanced military and space electronics, vastly experienced in control for industry. The science is there. The engineering is there. The reliability is there.

You'll be interested in the accuracy, the speed, the inspection and production savings. Contact a Cutler-Hammer sales office, check the publication inquiry number, or mail the coupon today for complete information. Gaging inquiries will be handled by gaging specialists.

Get more accurate production, fewer rejects with INCHWORM Type 202

Centerless grinders are freed from backlash, can maintain required tolerances in a way that will amaze you, when INCHWORM replaces the lead screw!

INCHWORM's ability to move either direction in microinch steps increases production as well as accuracy.

With automatic inspection and simple logic systems, INCHWORM will correct any off-dimension trends automatically. A virtual end to grinding scrap!

FREE TRIAL. Retrofit an INCHWORM to your grinder at our expense. Count your savings during the trial. Then prices start at $3,400 . . . usually quickly recovered.

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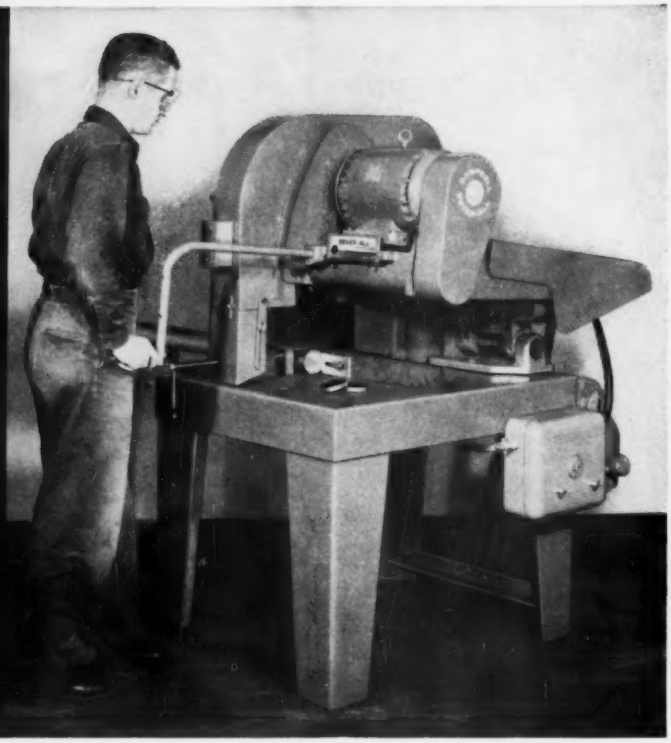
City_____ State_____

NEW!

GREATEST CUT-OFF CAPACITY IN ITS CLASS!



• This newest addition to the Sever-All line of abrasive cutting machines—the Model 2-A—provides greater cutting capacity and more flexibility than any other machine in its class. Check these important advantages:

Big capacity • cuts 4″ round or square solids, 6″ diameter tubing or standard pipe, 6″ x 1″ flat stock, 6″ angle iron and 8″ channels. Cuts practically all metals.

Fast operation • accurate cuts at the rate of 2 to 3 seconds per square inch. For instance, you can cut a 4″ bar of hardened steel in 45 seconds, or a 2″ pipe in 3 seconds.

Power oscillation • oscillation—the forward and backward motion of the cutting wheel as it is fed down into the cut—gives you extra cutting capacity without excessive horsepower load on your power lines. It also contributes to longer wheel life and reduced operator fatigue.

Quality cuts • clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting action.

Economy • Sever-All abrasive cutting wheels, developed specially for the Model 2-A, assure you of lowest cost per cut.

Safe • wheel guard provides complete operator protection.

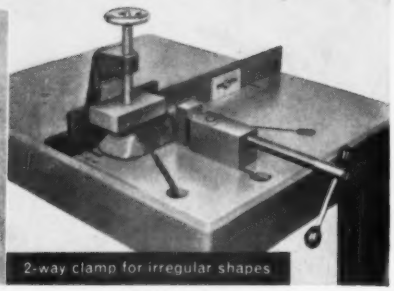
Minimum maintenance • all bearings are the pre-lubricated and sealed type. Clean, simple machine design permits easy housekeeping.

Built to last • rugged machine bed and rigid castings make the Model 2-A first choice for heavy-duty jobs.

VARIETY OF WORK HOLDERS GIVES UNUSUAL VERSATILITY

V-block with quick-action clamp

Angle-cutting work holder



2-way clamp for irregular shapes

Choose the work holders you need from several optional arrangements. These include the vise-type holder shown on the machine at top, plus the V-block, angle-cutting and 2-way clamp fixtures above. All fit interchangeably on the Model 2-A Sever-All. Screw-type and quick-action clamping also may be used interchangeably.

***Write for details** on the new Model 2-A Sever-All abrasive cutting machine. Ask for Bulletin DH-299*

ACCO

SEVER-ALL ABRASIVE CUTTING MACHINES

Allison-Campbell Division, American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

◄ CIRCLE 290 READER SERVICE CARD

▲ CIRCLE 291 READER SERVICE CARD

Avco puts the PlasmaGun to work—in your plant

This Avco PlasmaGun spray-coats metals, ceramics and refractories with a thickness, density and bond strength never before possible—right on your production line.

It sprays uniformly without clots or streamers at roughly half the cost of other plasma equipment. And you can save up to 30% over conventional spray-coating—even more when fabricating free-standing parts from materials such as tungsten.

The Avco PlasmaGun takes powders previously too fine for other plasma equipment. The cathode is adjustable, too, for convenience and economy. (No need to switch cathodes each time you change powders.)

The cost? Lower than you think. It can pay for itself on the first job. Maintenance? Easiest of any gun in the field. (The PlasmaGun assembles with only 4 bolts!) Warranties? On all parts, for six months. (Another exclusive Avco feature.)

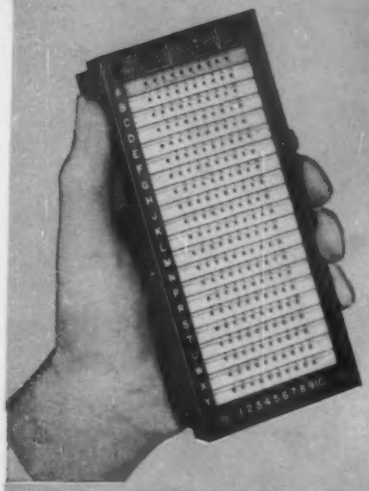
Avco
Research & Advanced Development
division

Avco's special PlasmaGun booklet describes the complete system. Send for your free copy right now!

AVCO Research and
Advanced Development Division
Dept. 10-3, Wilmington, Mass.
Please send free information about new PlasmaGun system.

Name_____
Organization_____
Address_____
City_____ Zone_____ State_____
Title_____

CIRCLE 292 READER SERVICE CARD



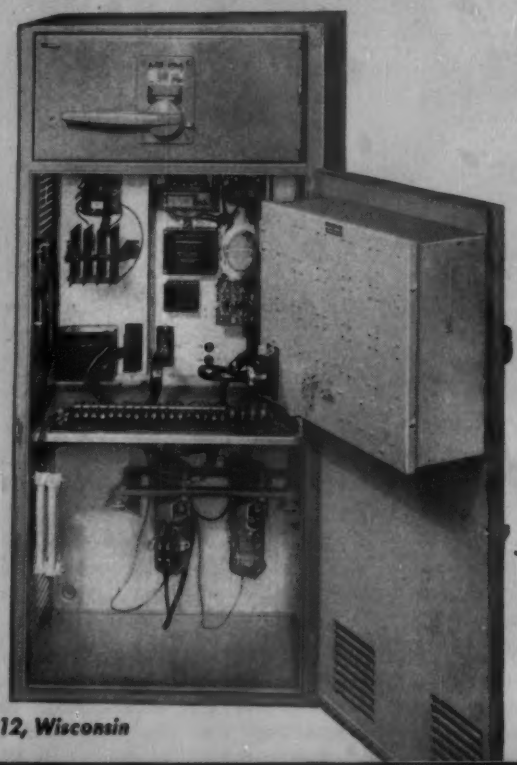
BETTER WELD QUALITY! LESS MAINTENANCE!

with SQUARE D NORpak WELDER CONTROL

Industry's FIRST Transistorized Standard Resistance Welder Control

MAINTENANCE IS PRACTICALLY NON-EXISTENT

because **NORpak** static control elements replace control tubes in the logic panel, eliminating the most common cause of trouble. **NORpak** transistorized units have no moving parts to wear, no filaments to burn out. They are encapsulated in epoxy resin for protection from atmosphere and physical damage, and are guaranteed against defects for one year. Versatility of **NORpak** units makes it easy to provide any special sequence required.



BETTER WELD QUALITY

results from greater timing accuracy. **NORpak** welder control is available with either resistor-capacitor timing circuits or cycle-counting circuits for absolute accuracy. Timing is not affected by normal line voltage fluctuations because of a built-in regulated power supply.

EASY-TO-HANDLE COAXIAL IGNITRON TUBES

are smaller, have higher peak current capacity, and are plastic-coated for greater safety.

OPTIONAL DISCONNECT SWITCH

available in 200 or 400-ampere rating, fusible or non-fusible. Power wiring is easy, and NEMA terminal markings are used throughout.

GET THE COMPLETE STORY...

Write Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled

The 1960 Golden Anniversary annual report of Norma-Hoffmann Bearings Corporation, Stamford, Connecticut, outlines the impressive progress resulting from their long range capital improvement program. By the careful selection of reliable capital equipment compatible with a comprehensive quality control system, Norma-Hoffmann customers are assured of a consistently fine quality product.

AN INDICATION OF PROGRESS AT NORMA-HOFFMANN

... Bryant Centalign® Grinders

Important factors in progressive statistical quality controlled production are the Bryant Model "C" Centalign Grinders shown here in the Norma-Hoffmann plant. Straight bores and precision bearing raceways are ground on the Centaligns with consistent accuracy . . . at record-breaking production rates.

Progressive manufacturers throughout the world are improving their competitive position with Bryant Centaligns. Engineered for quick changeover and minimum down time, every one is thoroughly "proved out" at Bryant by statistical quality control methods. Find out how a Centalign Internal Grinder can help you.

BRYANT

Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

CIRCLE 294 READER SERVICE CARD

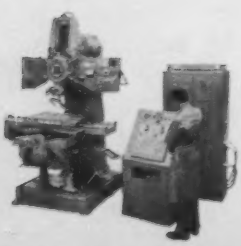
LIBRASCOPE DIVISION, GENERAL PRECISION, INC.

USES Burgmaster

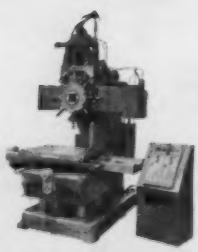
1,016 Operations Each Part Programmed in Tape Averages 36 Minutes for Each of Five Individual Set-Ups.

Over 300 Different Parts Programmed in Tape

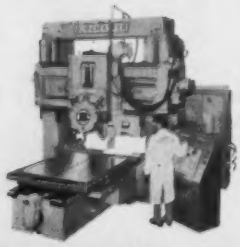
BURGMASTER MODEL 2BHT-L with Hughes Tape Control. Model 2BHT-L, 6 spindle, ¾" capacity in steel. Table travel 15 x 26.



MODEL 25AHT
6 spindle, 1¼" capacity in steel. Table travel 15 x 26, 20 x 30, 30 x 45.



MODEL 3BHT
8 spindle, 1½" capacity in steel. Table travel 20 x 30, 30 x 45.

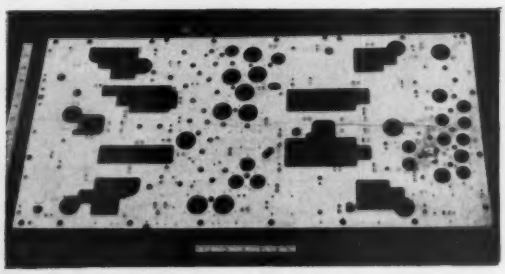


MODEL 3BHT-B
Double Housing Planer Type 8 spindle, 1½" capacity in steel. Table travel 48 x 60.

TAPE-CONTROLLED TURRET DRILLS

SAVES $1850.00 TOOLING COSTS...CUTS PRODUCTION TIME FROM 7.3 TO 2.2 HRS.

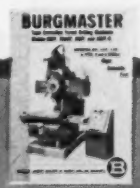
Librascope Division, General Precision, Inc., Glendale, California uses several Burgmaster Turret Drills to increase production and reduce costs. For example, over 300 different jobs are programmed in tape for use on their tape-controlled Burgmaster Model 2BHT-L. In this group there is a single part with 1,016 center drilling, drilling, tapping and reaming operations with tolerances as close as ±.0005 programmed in tape. As a result, production has been increased 330% with a labor savings of over 90%. Fixture savings on this one job amounted to $1850.00, with set-up time reduced to just 36 minutes for each of five set-ups. When you project this type of savings over 300 different jobs you can see why you should get the facts on Burgmaster Tape-Controlled Turret Drilling Machines.



6061T6 aluminum alloy digital computer base plate 14⅜" x 29³⁄₁₆" x ½" showing result of total 1,016 center drilling, drilling, tapping and reaming operations performed by Burgmaster Tape-Controlled Turret Drilling Machine.

—JOB FACTS—

Company: Librascope Division, General Precision, Inc., Glendale, California.
Machine: Burgmaster Model 2BHT-L (with Hughes' Tape Control) Turret Drilling, Tapping, Milling and Boring Machine.
Part: Digital computer base plate, 14⅜" x 29³⁄₁₆" x ½", 6061T6 aluminum alloy.
Lot Size: 10
Tolerance: ±.0005
Holding: Locating pins on sub base and simple clamps.
Machine Operations: Total 1,016 machine operations.
424 holes drilled
158 holes tapped
21 holes reamed
Former Method: Single-spindle drilling machines with fixtures.
Present Method: Tape-Controlled Burgmaster Model 2BHT-L Turret Drilling, Tapping and Boring Machine.
Savings: 5.1 hours per part, 90% of labor costs, and $1850.00 fixture cost.
Other Advantages: Greater accuracy, less cost, no scrap loss, eliminates operator fatigue, fast set-ups, economically handles mill lot work.



Send for Literature

Write for bulletin describing Burgmaster 6- and 8-Spindle Tape-Controlled Turret Drilling, Tapping and Boring Machines. Forty-minute, 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

Burgmaster CORPORATION

15001 S. Figueroa Street, Gardena, California • FAculty 1-3510, CAvis 9-4158
BURGMASTER DIRECT SALES OFFICES: Midland Park, New Jersey, 196 Greenwood Road, GIlbert 4-3002 • **Melrose Park, Illinois,** 2307 N. Mannheim Road, GLadstone 1-2828 • **Cleveland, Ohio,** ACademy 6-7030 • **Detroit 37, Michigan,** 13730 W. Eight Mile Road, LIncoln 8-4333 • **Northern California, Castro Valley,** 4611 Emily Court, JEfferson 7-1650 • **Kearney & Trecker, C.V.A. Ltd.,** Sole Agents for Great Britain, British Commonwealth and Western Europe • **Mitsubishi Corp.** for Japan, Far East, and South America.

World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ¼" Capacity

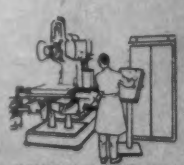
1C Manual Power Index ⅜" Capacity

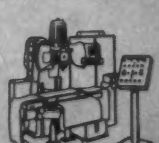
2B Manual Power Index ⅜" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity


25AH Automatic Tape Controlled 1¼" Capacity


2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

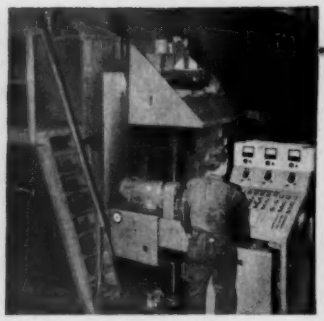
CIRCLE 296 READER SERVICE CARD

ANOTHER REASON TO SPECIFY **GENERAL ELECTRIC** NUMERICAL CONTROL

Cincinnati Gilbert Floor-type Horizontal Boring Mach., G-E Mark II NPC

Edlund Edlund-Matic (TM) Drilling and Tapping Machine, General Electric Mark II NPC

LeBlond Tape Turn Lathe, controlled by G-E Mark Century Numerical Contouring Control



Hill Beam Drilling Machine, General Electric Mark IV NPC

Moline Tube Sheet Drilling Machine, General Electric Mark II NPC

Fosdick Fosmatic Turret Drill with Automatic Depth Control, General Electric Mark II NPC

Brown & Sharpe Turr-E-Tape Six-spindle Turret Drilling Machine, G-E Mark II NPC

Wiedemann Turret Punch Press, General Electric Mark II NPC

Selected by 50 machine-tool builders,

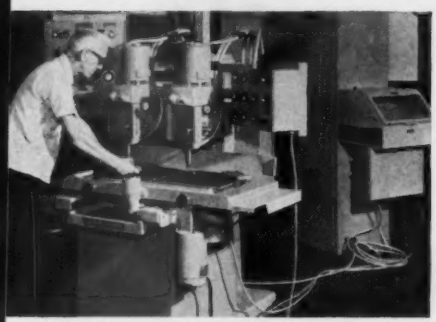
A double vote of confidence for General Electric's unmatched experience in designing, building, and applying numerical controls is evidenced by . . . the more than 50 builders who put them on the machines they sell . . . and, the over 500 American applications where they daily prove their outstanding performance on a variety of drilling, milling, punching, turning, and boring machines.

Many builders have used G-E automatic machine control since General Electric introduced electronic tracer control in 1943. Others selected G-E control based on the Company's pioneering work to develop the first magnetic tape contouring control in 1947. And many more turned to G.E. when the first building-block "packaged" positioning control—

CIRCLE 297 READER SERVICE CARD

NUMERICAL CONTROL
FOR AUTOMATION

American Tool Travelling 19-inch Column Openside Boring and Drilling Machine, General Electric Mark II NPC



Leland Gifford Two-head Printed Circuit Board Machine, General Electric Mark II Numerical Positioning Control

TODAY'S GENERAL ELECTRIC NUMERICAL CONTROL LINE features new Mark Century Numerical Positioning and Contouring Control (rear) and job-proved Mark Series Numerical Positioning Control for two to five motions (front).

proved in 500 metalworking applications

the Mark Series—was introduced in 1957. Its on-the-job record brought selection on 26 new machines exhibited at last year's Machine Tool Exposition.

And the current outlook is even brighter. New G-E Mark Century Numerical Control—utilizing solid-state circuitry—makes possible economical precision contouring with punched-tape input.

There are additional reasons to specify G-E numerical control: a full line to select from; nationwide service to minimize downtime; convenient time payment plan; and more that your machine tool builder or G-E Sales Engineer can tell you about. Or, write for descriptive bulletins to General Electric Company, Schenectady, New York. *Specialty Control Dept., Waynesboro, Virginia.* 795-13

Progress Is Our Most Important Product

GENERAL ELECTRIC

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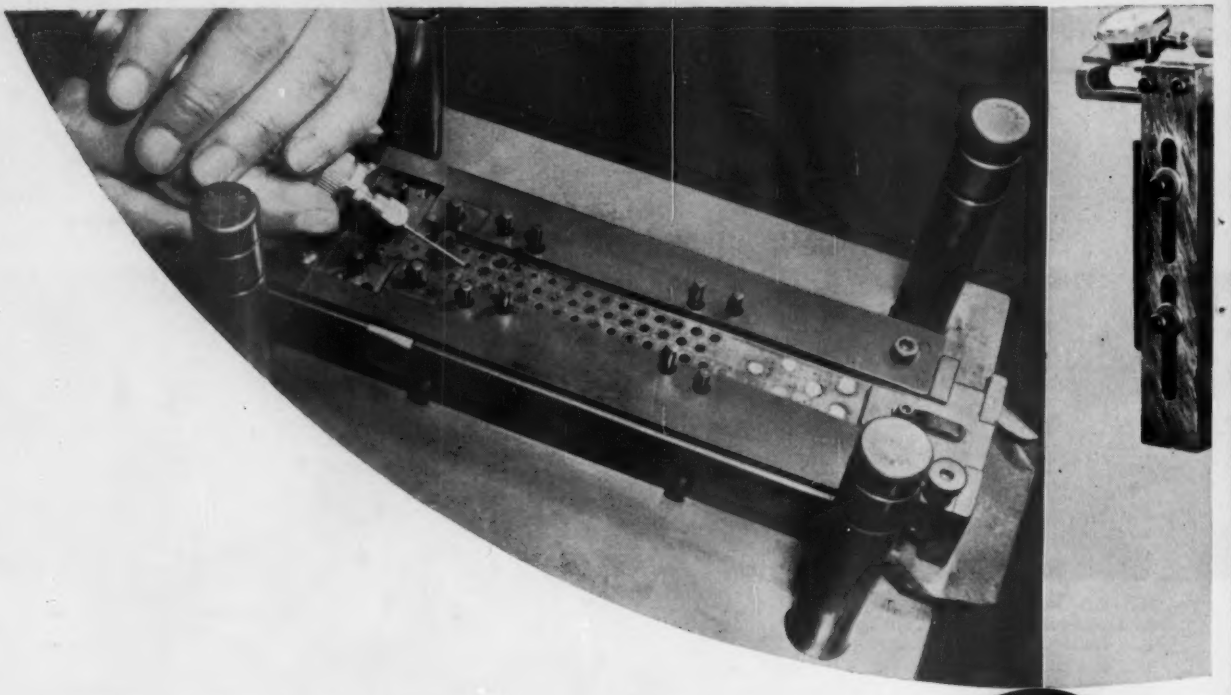
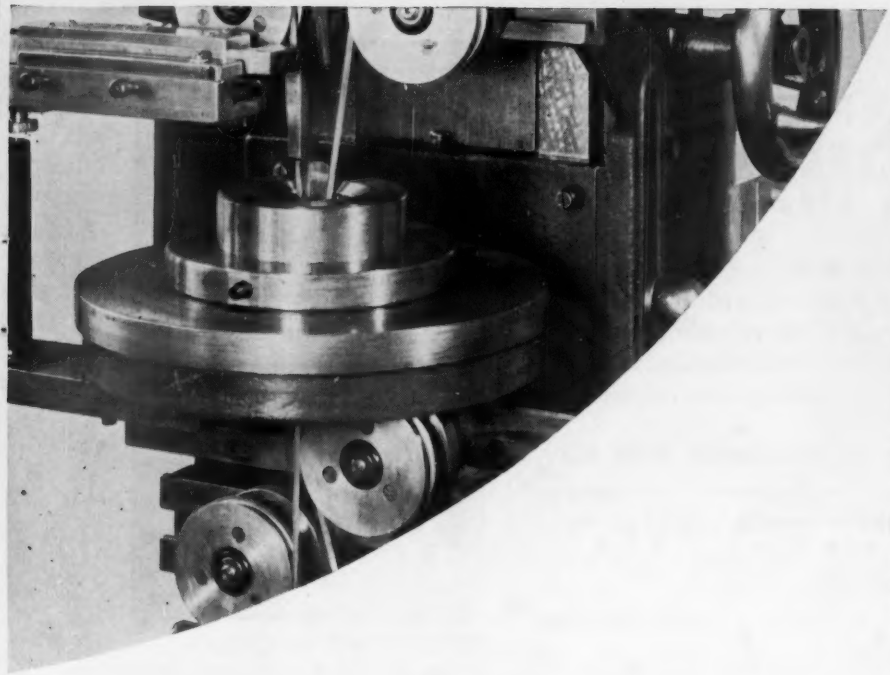


Grinding Ceramic Wafers *(below) for nuvistor tubes. Two diamond wheels finish 2000 wafers per hour for Electron Tube Division of RCA. Wheels remove 0.003" stock from each surface simultaneously. Previous method using abrasive belts ground only one surface at a time, resulting in nonuniform results and stoppages. Expected life of wheels: 5,000,000 wafers.* ▼

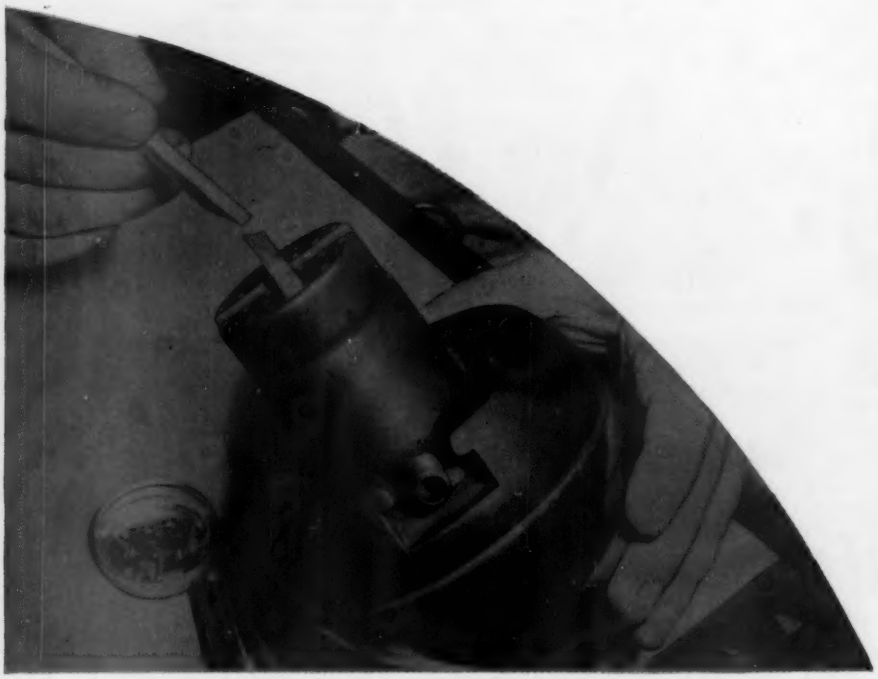
Servicing High-Speed Carbide Dies *(above). Jacoby Bender Inc. makes expansion watch bands. Their dies are for precious and semiprecious metals, as well as stainless steel. Finished products must have flawless finish. Small diamond quills from size .020" to ¼" diameter are used to build and service carbide dies. Grinders also cut decorative relief in some dies.* ▲

Industrial diamonds cut practically everything . . . especially your production costs



Polishing Drawing Dies *(above) for Chase Brass & Copper. Die-polishing job that once required 2 to 6 hours' handwork is now finished in 15 minutes with diamond belt polisher. Accuracies and surface finishes are also greatly improved. Belts are impregnated with 100, 200 or 300 mesh natural diamond grit. Up to 200 dies have been serviced by a single belt.*

Putting Mirror Finish *(below) on hardened steel part for a forming die at Jacoby Bender. The natural diamond micron powder is applied with a wooden lap. The diamond paste speeds up the polishing operation, and has less tendency to distort the true form of the tool-steel than methods previously used.*



Considering how well natural diamonds do these jobs may give you ideas

The four grinding and polishing jobs shown here span the fields of electronics, jewelry making, and metalworking. But they have one thing in common: in every case, natural industrial diamonds are doing the job quickly, economically and well.

In diamonds, you find this unique combination of properties: excellent cutting ability coupled with fantastic endurance.

Result: your diamond tools last longer than any other tools you can use. Your people spend more time producing, less time changing tools.

If you cut, sharpen or smooth in your business, you quite probably can use natural diamonds to advantage. Test them against the method you're now using. You will see how efficient — and economical—a diamond can be, especially now.

Best grit for metal-bond wheels developed by the Diamond Research Laboratory in Johannesburg

A new impact crushing method for natural diamonds is now producing the strongest and most durable diamond grit ever obtained for metal-bond wheels. Your tool and wheel manufacturer is ready to help you select the diamond tool that's right for *your* job.

Industrial Distributors (Sales), Ltd.

NOW 7* STANDARD LAPMASTERS

FOR PRECISION LAPPING

to a flatness of .0000116" or less with a micro-inch finish of 2 to 3 RMS. All Lapmasters will maintain this uniform accuracy piece-after-piece because conditioning rings continually condition the lap plate during entire lapping cycle.

IN SMALL LOTS OR THOUSANDS PER DAY

with consistent accuracy. Production is not interrupted or slowed down for replacing or reconditioning lap plates.

OF PARTS UP TO 32" DIA.

and as small as ⅛" dia. Accurately laps paper-thin pieces as well as giant two-ton parts.

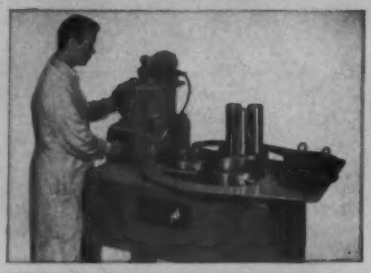
OF ANY SHAPE, FORM OR MATERIAL

tall or squat, long or short, flat or odd shaped . . . any metal, ceramics or plastic all at the same time if necessary. Inexpensive work holders eliminate danger of stresses and warping usually caused by clamping during grinding or milling.

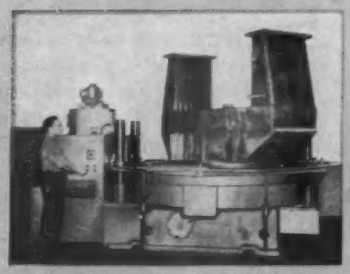
**For your special lapping requirements, we will build Lapmasters any size.*

MODEL 10 for maintenance lapping of parts up to 3-11/16" dia.

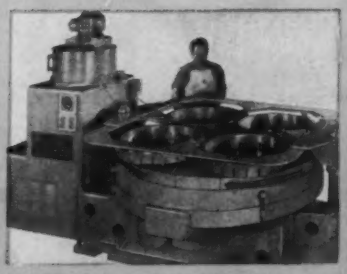
MODEL 12 for parts up to 4" dia.



MODEL 24 for parts up to 9½" dia.



MODEL 84 for parts up to 32" dia.



MODEL 72 for parts up to 27" dia.

MODEL 36 for parts up to 14½" dia.

WRITE FOR THE COMPLETE LAPMASTER STORY

Write for bulletins describing the Lapmaster line and chart on measuring flatness.

MODEL 48 for parts up to 17" dia.

Lapmaster ... THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

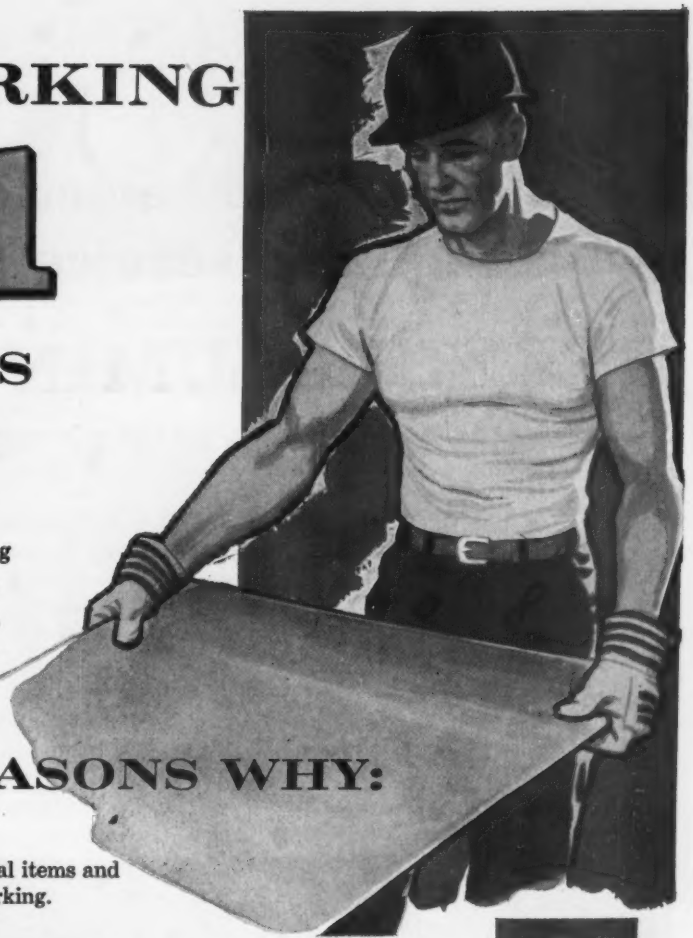
A product of

Crane Packing Company

6436 OAKTON STREET • MORTON GROVE, ILLINOIS (Chicago Suburb)

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

METALWORKING IS No.1 IN FLORIDA'S INDUSTRIAL EXPANSION



● In only 5 years, 1096 metalworking plants have moved to or expanded in Florida's Better Business Climate . . . the best under the sun. Employment has grown from 23,900 to 48,600.

FIVE STAR REASONS WHY:

- Florida manufacturers of industrial items and consumer products need metalworking. The need is growing daily.
- Florida taxes are lower. *No state, corporation or personal income taxes.* Your inquiry will be answered with an outline of the complete tax structure.
- Plant building costs are lower in Florida. One Tampa Bay electronics manufacturer built for 50 per cent less than in the north. Air conditioned, too! Operating costs are lower in Florida.
- Ample personnel is available. High calibre technicians, skilled and semi-skilled production employees.
- Profits are higher in Florida. ⅓ more is not unusual.

FLORIDA'S ASSURANCE POLICY

"You have my personal assurance of a sunny business climate here in Florida. You have positive assurance of every aid and assistance possible from our Florida Development Commission and from the overwhelming majority of our businessmen, industrialists, and financiers. We have everything to make your large or small enterprise healthy and successful. Write, wire or phone us TODAY. The only thing better than a FLORIDA vacation is having your plant here."

Governor, State of Florida

Investigate DEBT-FREE

Florida

...A 10 BILLION DOLLAR MARKET

Ask about free film "Profile of Progress."

Mr. Wendell Jarrard, Chairman
Florida Development Commission
Box 4124-A, Tallahassee, Florida

Please send me "Plant Location Guide" containing all the facts about Florida's opportunities for New Industry, the 10 BILLION DOLLAR CONSUMER MARKET, Labor, Climate, Schools, Natural Resources, Favorable Tax Structure.

Name.....

Firm Name.....

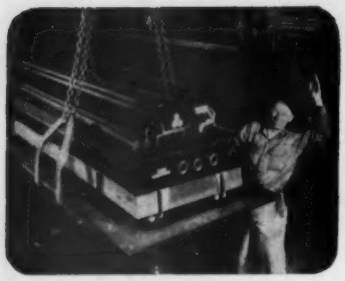
Address.....

City.....Zone.....State.....

FLORIDA FOR CONVENTIONS—Write for free information on Florida's wonderful facilities for your group meeting.

unlimited selection –unequaled service on...

STEEL • ALUMINUM PLASTICS MACHINERY

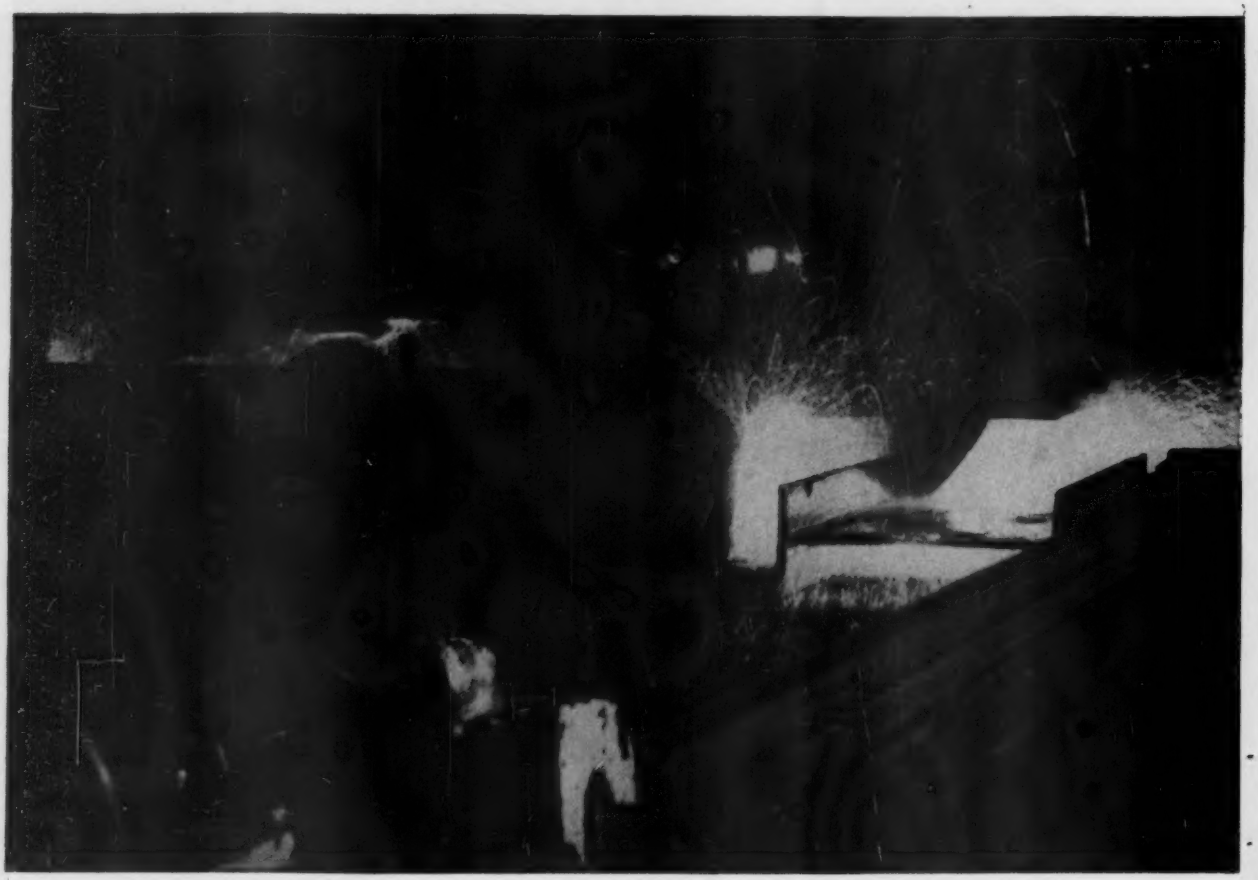


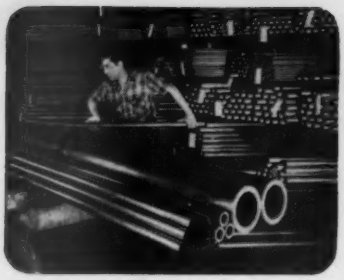
CARBON STEEL—No one even approaches the size and diversity of our stocks of hot rolled bars, plates, structurals. Published tolerances assure the industry's most exacting sawing, shearing and flame-cutting.

At Ryerson you will find the broadest selection of steel and aluminum in all types and sizes—plus plastics and machinery. Thus, you're assured of unbiased recommendations on material and metal-fabricating machines to speed production and reduce costs.

And backing up the size and diversity of stocks are these important services: certified quality controls; expert technical help; industry's closest cutting tolerances; dependable, on-time delivery.

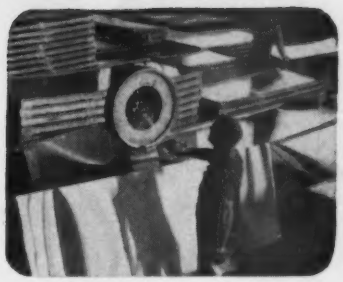
Take a quick tour of Ryerson on these pages, then contact your Ryerson representative for details.



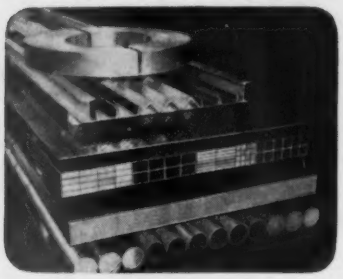


TUBING & CF BARS—Tubing: seamless and welded mechanical; structural; hydraulic cylinder & fluid line; Ledloy® 170. Bars: shafting, machinery steel, accuracy and screw stock, including fast-machining Ledloy 375 and 300.

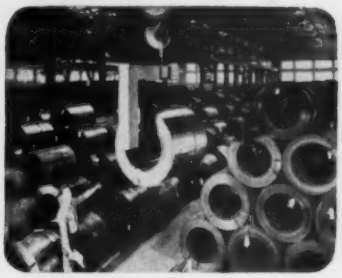
ALLOY STEEL—8-step certified quality program assures riskproof alloys—case-hardening, direct-hardening heat-treated alloys; leaded alloys, including fast-machining Rycut® steels; aircraft quality alloys; etc.



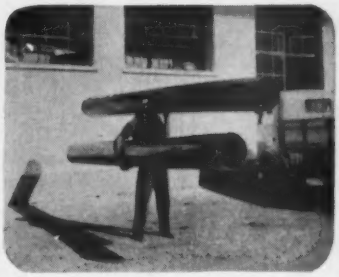
STAINLESS STEEL—2351 sizes, shapes, types and finishes in sheets, plates, bars, tubing, pipe and fittings, etc. All certified to meet ASTM, SAE, military, DuPont or GE specifications. Check in for fast stainless service.



ALUMINUM—Nation-wide service on Reynolds aluminum includes all mill products: sheets, plates, tubing and pipe; wire rod and bar; structural and extruded shapes; construction products for buildings and highways.

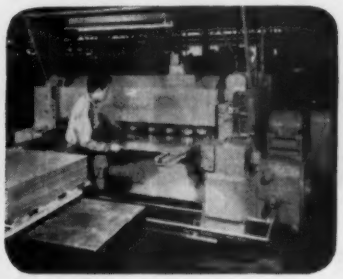


SHEET & STRIP—More than 20 kinds of stock sizes—or we can cut sheets to your order with latest shears, slitters and cut-to-length lines for faster service. Also strip coils, etc. Call us for all your sheet and strip requirements.



INDUSTRIAL PLASTICS—Ryertex-Omicron PVC pipe, tubing, sheet and rod conquer more than 281 corrosives. Also rigid Kralastic and flexible polyethylene pipe and Ryertex® laminated phenolic resin plastics.

This big friction saw bites through a 24" beam in less than 12 seconds. The accuracy of Ryerson cutting on all types of equipment is the closest in the industry.



MACHINERY—More than 3800 types and models of metal-fabricating equipment for bending, braking, drilling, forming, hoisting, pressing, punching, rolling, sawing, shearing, threading and welding.

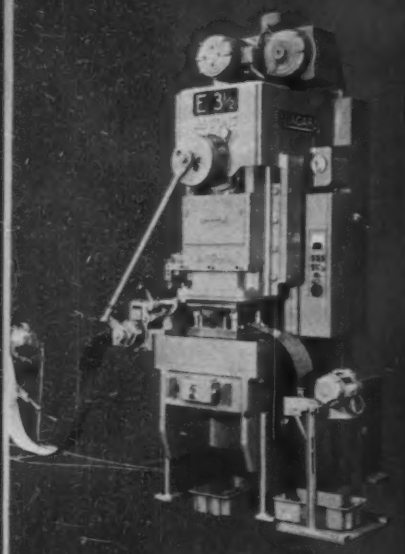
BE METALOGICAL—All the plus values of our products and service add up to giving you "optimum value for every purchasing dollar. Whatever you need—steel, aluminum, plastics, machinery—be Metalogical, call Ryerson.

RYERSON METALOGICS

JOSEPH T. RYERSON & SON, INC., MEMBER OF THE REPUBLIC STEEL FAMILY

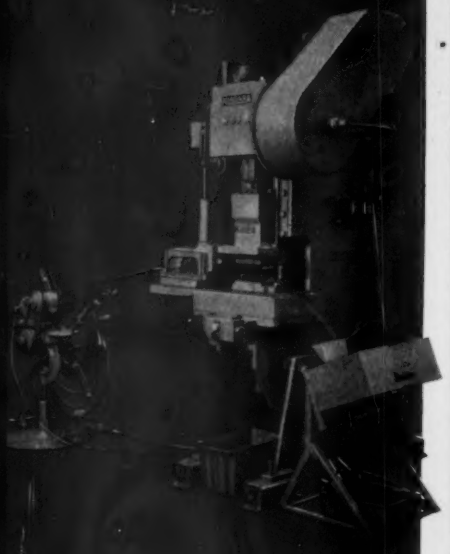
STEEL · ALUMINUM · PLASTICS · METALWORKING MACHINERY

PRECISION PARTS BY THE MILLIONS



SERIES E — FRONT-TO-BACK CRANKSHAFT OBI's
Capacities: 45 to 200 tons.
45-ton model (above) stamps out fuse tips at rate of million/day.

SERIES SA-2 STRAIGHTSIDE AUTOMATICS
Capacities: 25 to 300 tons.
100-ton package (above) includes double roll feed, stock reel, scrap cutter.



SERIES M — ULTRA-HIGH SPEED OBI's
Capacities: 22 to 60 tons.
35-ton model shown operates at adjustable speeds up to 1000 spm and produces parts at rate of million/day.

3 great Niagara lines excel in automatic, high speed, progressive die work

Premium construction: It's the key to premium performance here! These modern Niagara presses are designed strictly for automatic, high speed, progressive die work.

Model for model, they'll turn out more parts per hour than conventional presses of equivalent tonnage can even approach. Far heavier and more massive, they have the ruggedness, rigidity, and stamina to run vibration-free at high speeds.

Providing more guiding surface, their gibbing holds slide and bed in precise alignment for precise production, longer periods between die grinds, and longest possible die life.

But this just begins to tell the story . . .

YOU'RE INVITED TO CHECK all the features of these production-boosting machines. Illustrated Bulletins 54 (Series M), 56 (Series E), and 264 (Series SA-2), will be mailed on request. Write: Niagara Machine & Tool Works, Buffalo 11, N.Y.

NIAGARA

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

CIRCLE 305 READER SERVICE CARD

Super is the word for...

Super END MILLS

Super Tool's End Mills are specifically manufactured to meet the highest standards of quality workmanship and rugged, long-lasting performance.

Super carries a complete line of solid Carbide and Carbide tipped mills with 2, 3, or 4 flutes, straight or tapered shanks. Each End Mill is selected for the best possible performance on all materials.

Super Shear End Mills feature Carbide tips that run uniformly the full length of each high helix angle flute. This design assures cleaner, smoother cutting action and in turn, requires up to 25% less machine power.

Super Tool stocks a complete line of End Mills, or, they will make them to *your* specifications. The last word . . . for the finest performance on your milling operation . . . is SUPER TOOL! BACKED BY PROVEN PERFORMANCE IN THE FIELD!

SUPER . . . THE TOOLS THAT TESTIFY IN THEIR OWN BEHALF . . . BY GIVING LONGER LIFE AND PRODUCING AT LOWER COST.

Super TOOL COMPANY
Division of Van Norman Ind., Inc.

SUPER TOOL COMPANY
First and Bridge Sts. • Elk Rapids, Michigan

New ARMSTRONG "90" SERIES RATCHET

The ONLY Ratchet with ALL these important features!

1. Slenderized head
2. Thumb-operated reversing lever specially designed so it won't come off
3. Reversing-lever stop (Ball-and-spring prevents accidental shifting)
4. Simple to clean—only tool required is a Phillips screwdriver (wearable parts may be individually replaced)
5. Thin handle with knurled grip
6. Hole in handle for convenient hanging
7. Fine-toothed gear
8. Easy ratcheting action
9. ¼", ⅜", and ½" square drives (two handle lengths in ½" drive)

All wearable parts of ARMSTRONG Ratchets can be replaced individually, inexpensively, and easily. Entire ratchet handles need not be replaced in the event of tooth wear, as is necessary with ratchets in which the teeth are formed in the head of the handle.

* The name ARMSTRONG on these fine tools is your assurance of highest quality. Manufactured under strict quality control, all ARMSTRONG Tools can be used with confidence.

Extra heavy duty "50" Series ARMSTRONG ratchets (illustrated at right) are manufactured in 1", ¾", ½", and ⅜" square drive sizes. For complete information on these, as well as the approximately 5500 other tools in the ARMSTRONG Line, see General Catalog #700. Your local ARMSTRONG Distributor can supply you with Catalog #700 and can show you the new "90" Series Ratchets. If you do not know who handles the ARMSTRONG Line in your area, we will be glad to furnish this information upon your request.

EXTRA HEAVY DUTY RATCHETS

SOCKETS

WRENCHES

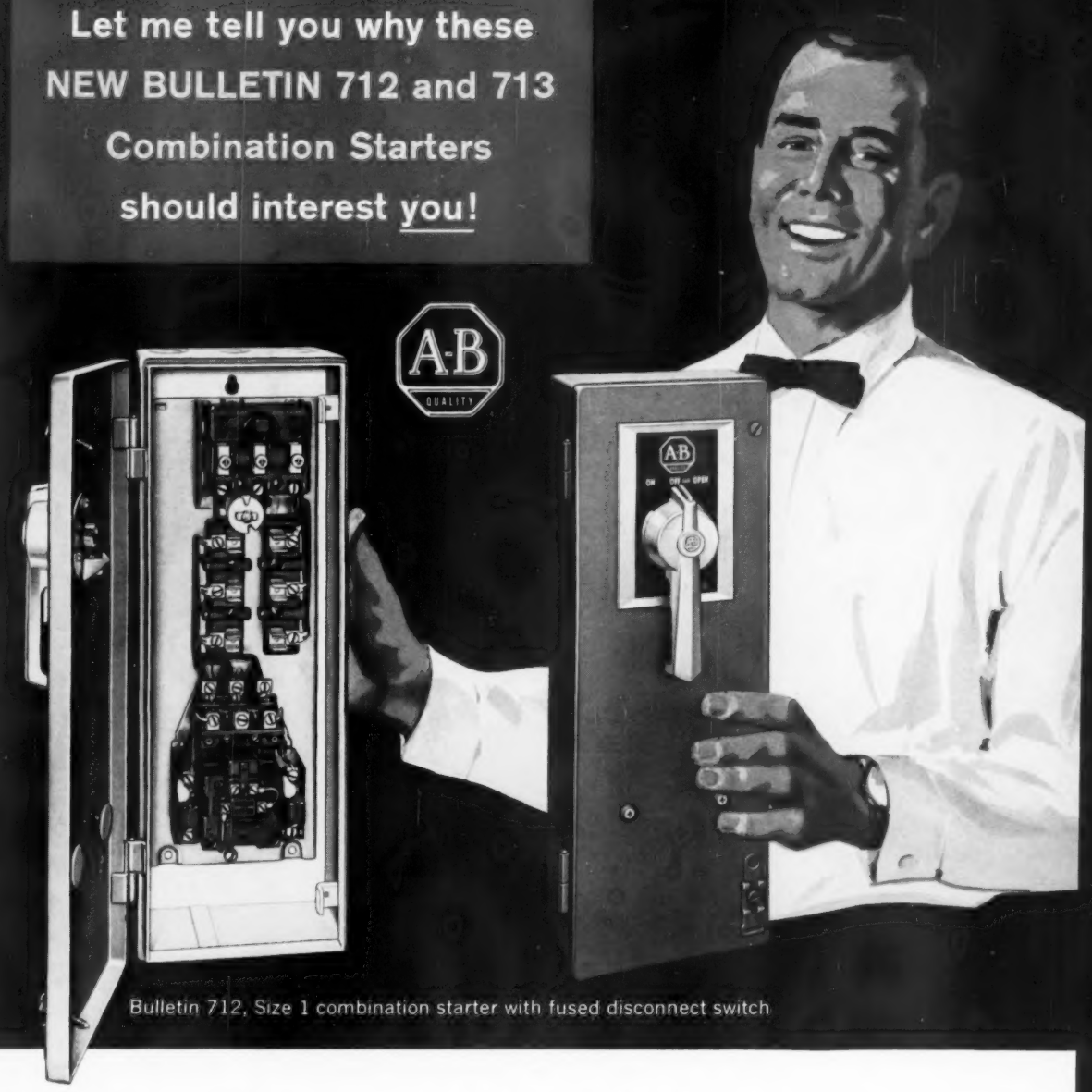
WRENCH SETS

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

5215 W. ARMSTRONG AVE. • CHICAGO 46, ILLINOIS

Let me tell you why these NEW BULLETIN 712 and 713 Combination Starters should interest you!



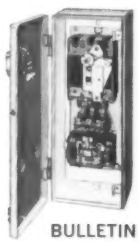
Bulletin 712, Size 1 combination starter with fused disconnect switch

They have – Smaller Size...Greater Switching Capacity... Greater Reliability...Longer Life...Complete Safety... Generous Wiring Room...Simple Design...Businesslike Beauty

Rating for rating, the new Bulletin 712 motor starter will outperform and outlast all others. Complete safety for the operator is assured because the cabinet door cannot be opened until the lever is moved to the OPEN position, which opens the visible contact disconnect switch.

The Bulletin 713 combination starter provides similar features for complete safety, but uses an ITE circuit breaker as a method of disconnecting.

Brooks Stevens, famous industrial designer, has given the entire line of enclosures, an undeniable "eye appeal"—an asset to any modern machine tool or industrial installation. Please write for details, in Publication 6100: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wis.



BULLETIN 713
Combination Starter with Circuit Breaker in Nema Type 1 Enclosure.

19-61-RM

ALLEN-BRADLEY

Member of NEMA

QUALITY
MOTOR CONTROL

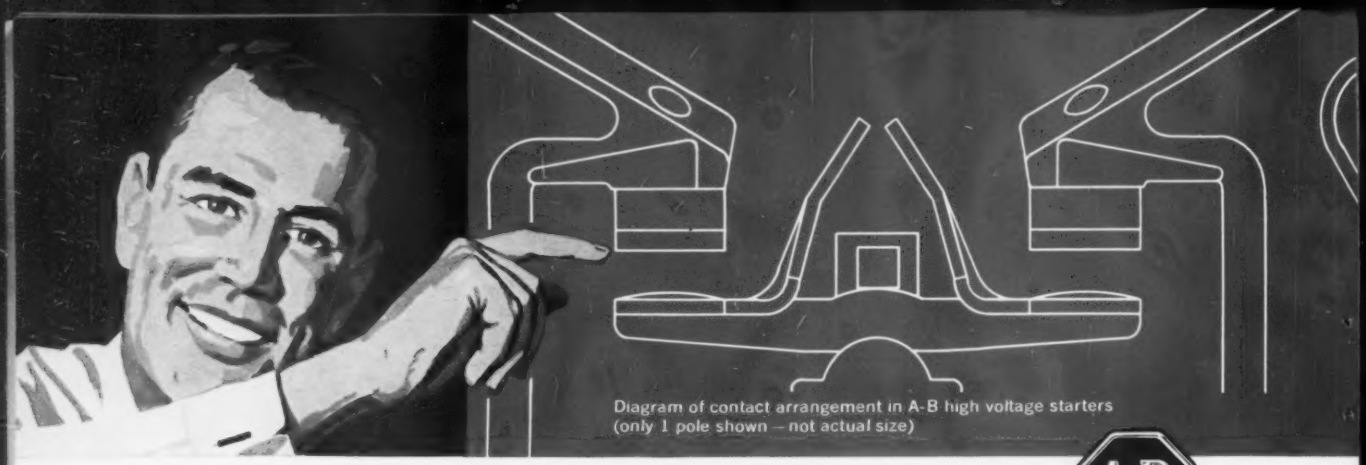


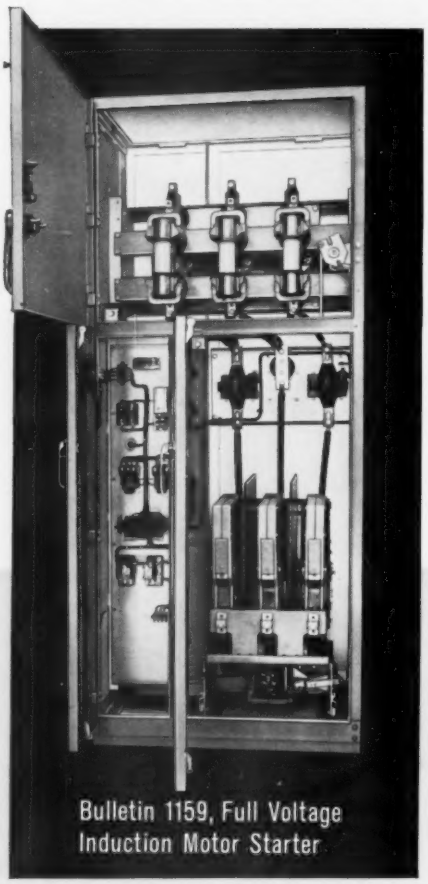
Diagram of contact arrangement in A-B high voltage starters
(only 1 pole shown – not actual size)

Would You Believe That

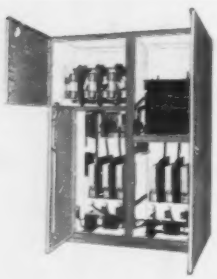
3/8 OF AN INCH IS THE REASON

for the Reliability and Long Trouble Free Life of A-B Starters Rated at 1500 hp, 2300 v; 2500 hp, 4600 v!

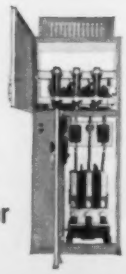
Allen-Bradley high voltage starters were designed and are built to provide millions of trouble free operations. An astounding claim—for this class of apparatus—but *true!* The extraordinary performance of the air break contacts is the result of extremely short contact travel—only 3/8 "! Naturally, such short travel reduces pounding and contact wear to a minimum. Also, the famous Allen-Bradley solenoid principle of operation is so simple that nothing can go wrong. Maintenance-free, double break silver alloy contacts are used throughout. Allen-Bradley high voltage starters are available for all types of motors and all types of service. For full details please write today for Bulletin 6080 to: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.



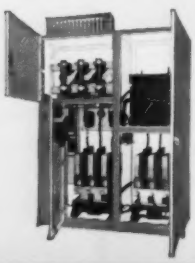
Bulletin 1159, Full Voltage
Induction Motor Starter



Bulletin 1172, Reduced Voltage
Induction Motor Starter



Bulletin 966, Full Voltage
Synchronous Motor Starter

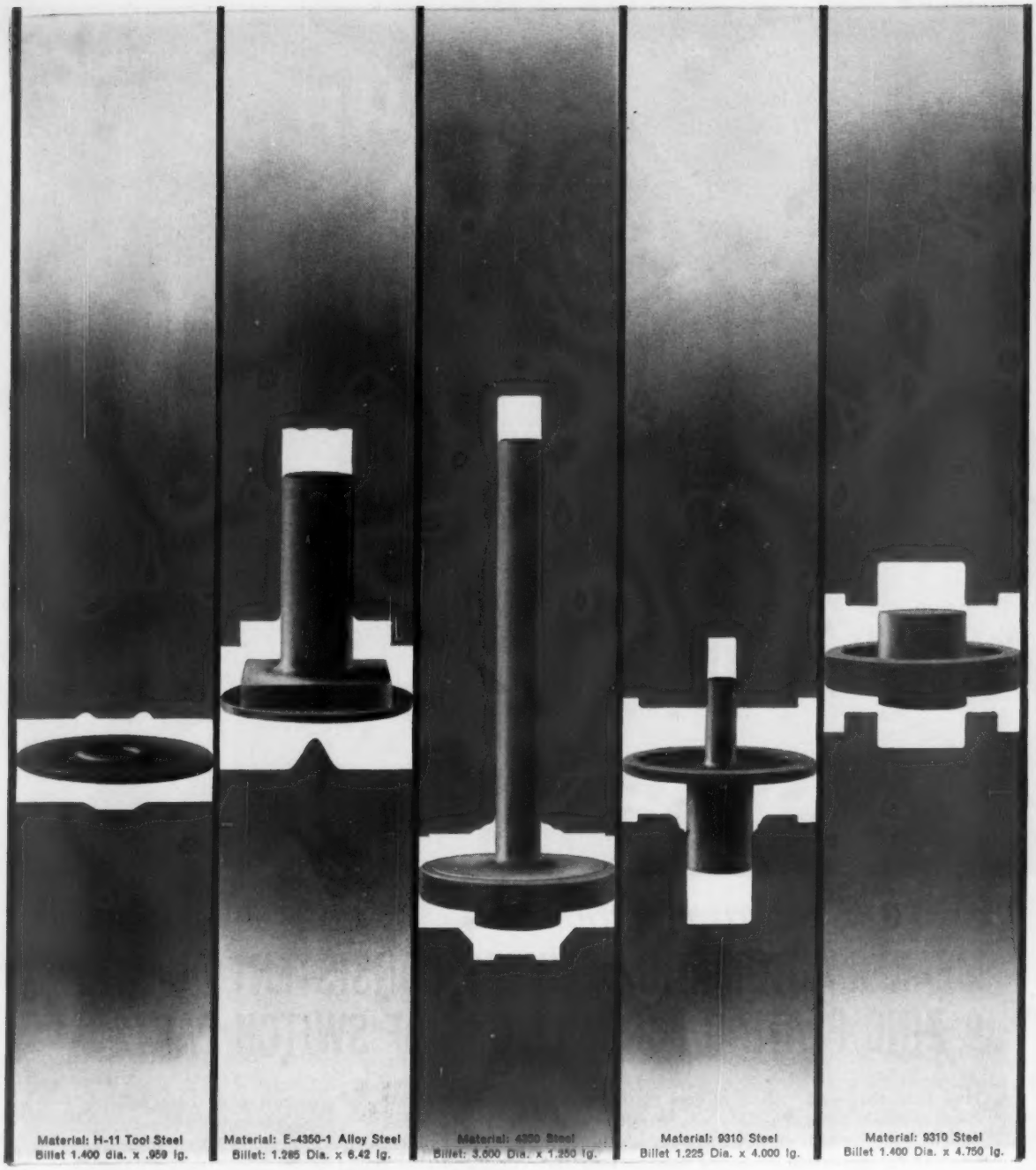


Bulletin 983, Reduced Voltage
Synchronous Motor Starter

19-61-RM

ALLEN-BRADLEY

QUALITY
MOTOR CONTROL


Material: H-11 Tool Steel
Billet 1.400 dia. x .959 lg.
Material: E-4350-1 Alloy Steel
Billet: 1.265 Dia. x 6.42 lg.
Material: 4350 Steel
Billet: 3.600 Dia. x 1.250 lg.
Material: 9310 Steel
Billet 1.225 Dia. x 4.000 lg.
Material: 9310 Steel
Billet 1.400 Dia. x 4.750 lg.

High-Energy Rate PRODUCTION ABILITY in one dynamic stroke! In this advanced, highly technical field, DYNAPAK high-energy rate metalworking equipment maintains consistent leadership through proven production ability. In support of this recognized position, illustrated above are forgings from BENDIX CORPORATION-UTICA DIVISION, where DYNAPAK is demonstrating its performance reliability in day-after-day production runs. DYNAPAK one-shot forging, extruding and metals compaction equipment increases savings, improves metal properties and reduces waste material. Closer tolerance controls, and the low micro finish of the "as forged" parts, are distinct advantages in DYNAPAK metalworking machines. Conventional or exotic materials, simple or complex shapes . . . DYNAPAK has few limitations. DYNAPAK metalworking machines are capable of making a part — in one stroke — that can be put to use with little or no machining. Apply DYNAPAK to your metalworking operations — it's the only *really new* proven concept in the industry.

Write for complete information to: Advanced Products Department, P.O. Box 6231, San Diego 6, Calif.

GENERAL DYNAMICS | ADVANCED PRODUCTS DEPARTMENT

◀ CIRCLE 309 READER SERVICE CARD

CIRCLE 310 READER SERVICE CARD

At Western Electric

MEAKER AUTOMATIC DELIVERS CONSISTENT QUALITY ZINC PLATING FOR MILLIONS OF SWITCH PARTS

How large the world? No more than the minutes it takes to telephone *anywhere!* A pioneer in communications is the Western Electric Company which builds years of rugged service into every piece of telephone equipment produced at its extensive Hawthorn Works, Chicago. Superior performance is a never-ending quest of Western Electric production engineers.

The Meaker "Automatic" was chosen and installed four years ago to zinc plate switch mounting plates and relay covers. These are parts of busy telephone central offices—the communication nerve centers of offices and factories throughout the United States.

Since 1899, Meaker engineers have been building automatic metal processing equipment. These range from units tailor-made to fit limited floor space and handle modest output to the largest plating installation in the world!

Whether large or small, every Meaker is made to save its owner money—through lower labor costs, greater plating uniformity and greatly improved product quality. Send for our new catalog "When to Automate" which will give you some valuable ideas on improving your profits—and products—through automatic plating or metal finishing.

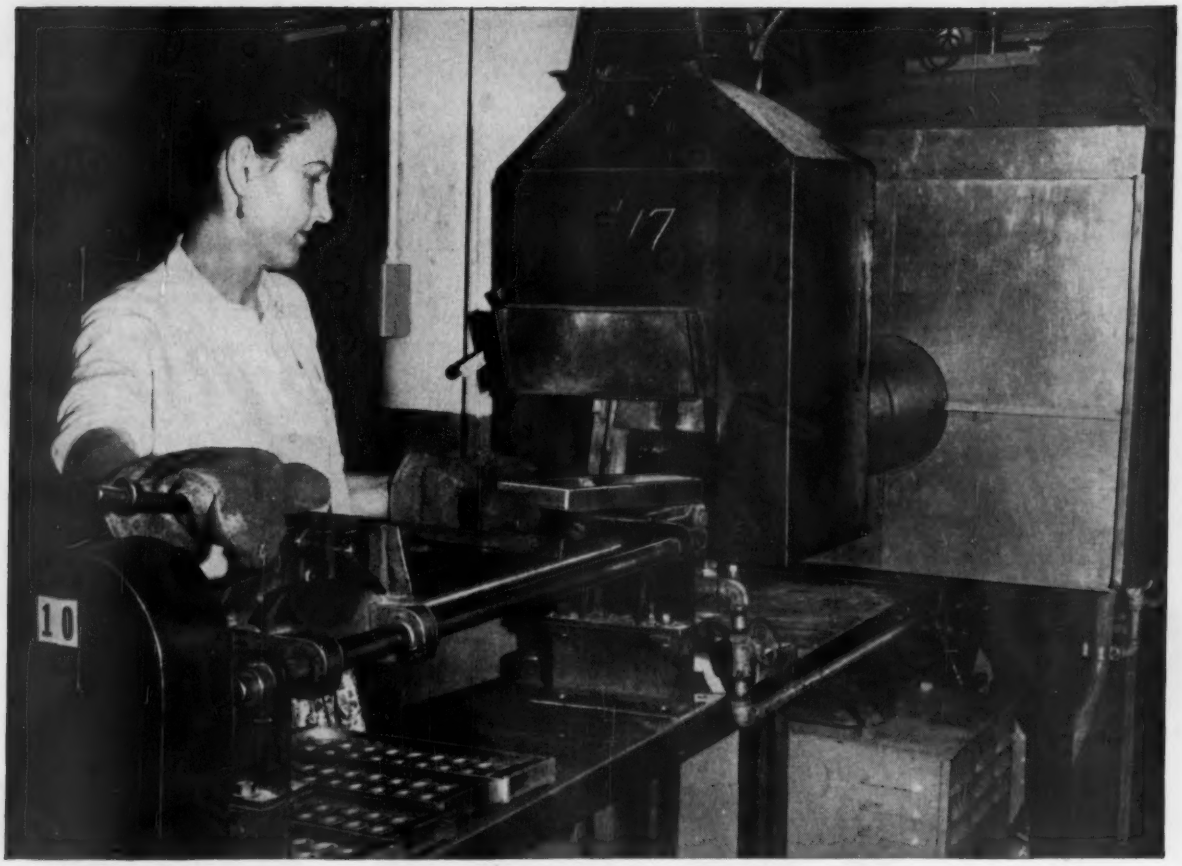
SINCE MEAKER 1899

THE MEAKER COMPANY

SUBSIDIARY OF SEL-REX CORPORATION

Nutley 10, New Jersey

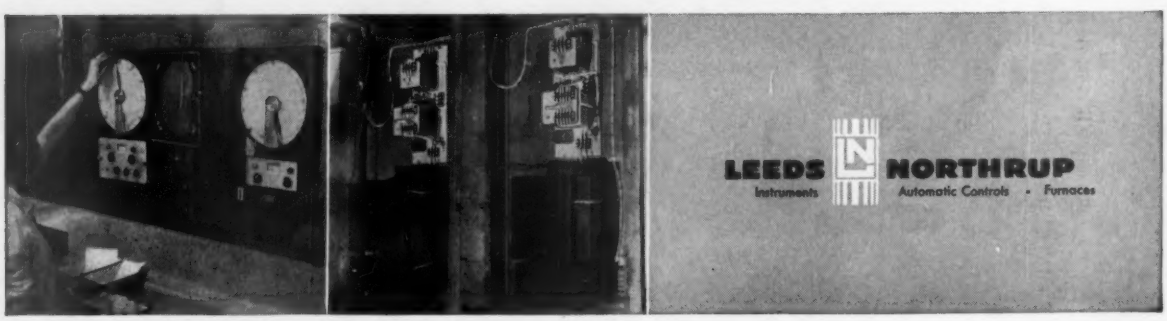
Factories and offices Chicago 50, Ill., Los Angeles, Cal. and Nutley 10, N. J.



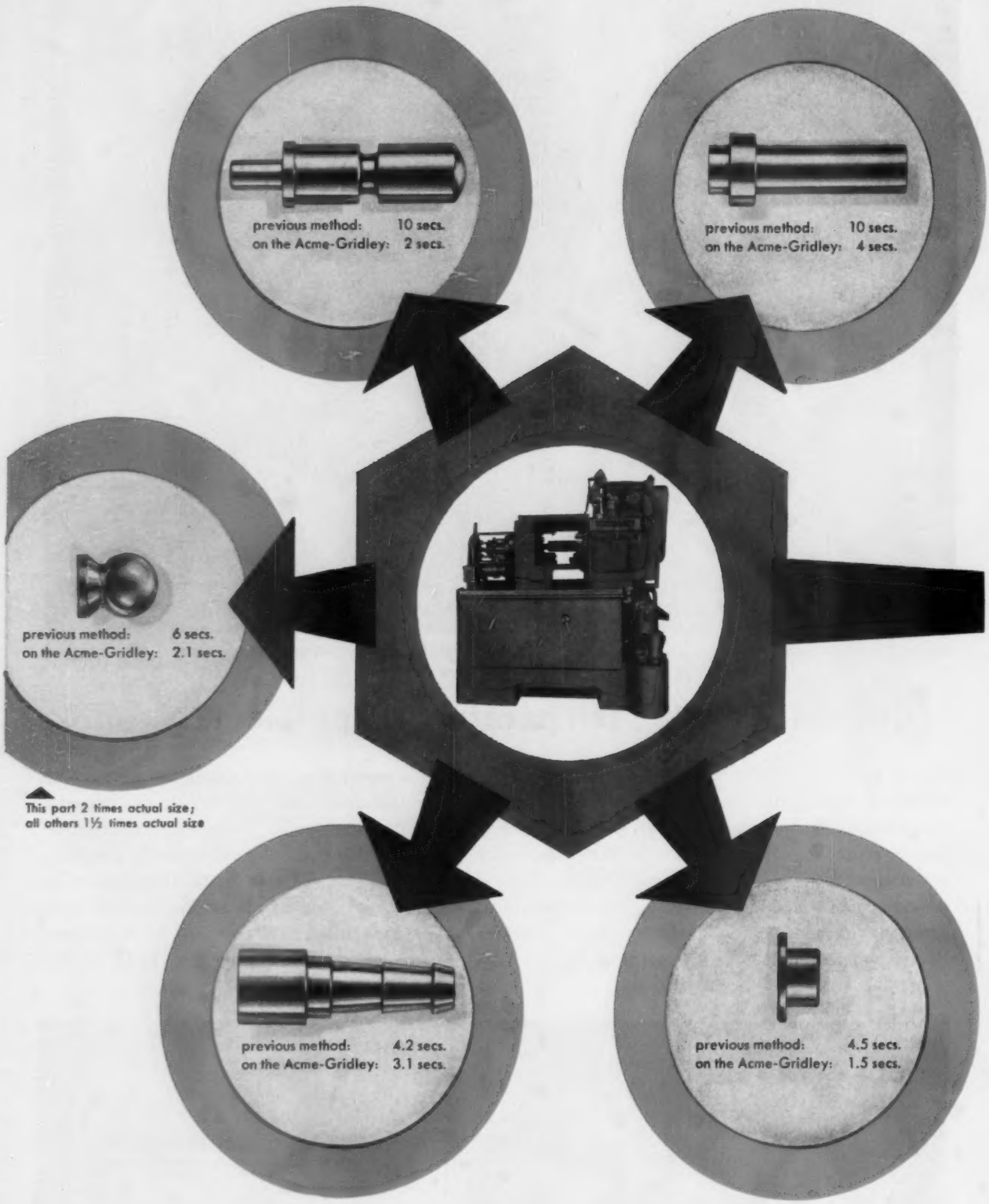
Fansteel Metallurgical Corp.: Operator loads sintering furnace with trays of FASTELL® heavy duty electrical contacts.

Critical sintering temperatures a problem?

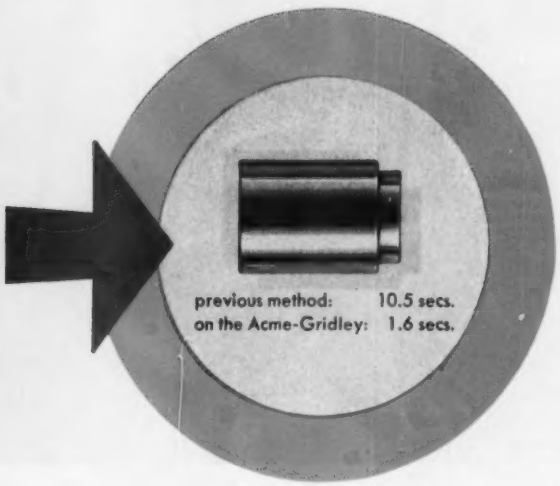
Not at Fansteel Metallurgical Corp., where Speedomax® H is regulating moly heaters and simplifying control of critical sintering temperatures. With temperature dependent upon load density and compact composition, Fansteel depends upon experience for the right temperature . . . upon Speedomax H for control reproducibility. Rugged, compact and completely reliable, this controller continuously regulates power input to moly heaters . . . holds furnace temperature well within specified limits. Speedomax H is providing the same dependable control on numerous heat treat processes . . . is helping produce both process economies and a quality product. *Whatever your heat treat, it'll pay you to investigate Speedomax H!* For details, contact your nearest L&N office or write 4946 Stenton Ave., Phila. 44, Pa.



"H" C.A.T. control brings furnace from 900 to 1300 C in 16 minutes without overshoot or hunting. Magnetic amplifiers are conveniently mounted on panel back.


previous method: 10 secs.
on the Acme-Gridley: 2 secs.
previous method: 10 secs.
on the Acme-Gridley: 4 secs.
previous method: 6 secs.
on the Acme-Gridley: 2.1 secs.
This part 2 times actual size; all others 1½ times actual size
previous method: 4.2 secs.
on the Acme-Gridley: 3.1 secs.
previous method: 4.5 secs.
on the Acme-Gridley: 1.5 secs.

ACME-GRIDLEYS SLASH AVERAGE MACHINE TIME 68%...

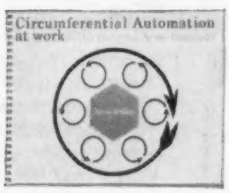


Pay off in profitable new business for screw machine job shop...

Before installing three Acme-Gridley 7/16" RA-6 Spindle Automatics, Carleton Screw Products Co. of Minneapolis found it difficult to keep pace with the demand for greater precision and quality required by current manufacturing standards. Consequently, high costs resulting from slow production methods made Carleton less competitive on short run, small part jobs.

With Acme-Gridleys, it's a different story. Short run, small part jobs are Carleton's bread and butter. The Acme-Gridleys cut average machine time 68% and always produce precision parts that surpass customer specs . . . giving a big boost to Carleton's "repeat order" business.

The 7/16" was *designed* for top economy in the mass production of miniature and sub-miniature parts. It's compact, rugged and has the versatility to handle an amazing variety of jobs. In your shop . . . for years to come . . . it will pay off in lower costs and higher earnings.

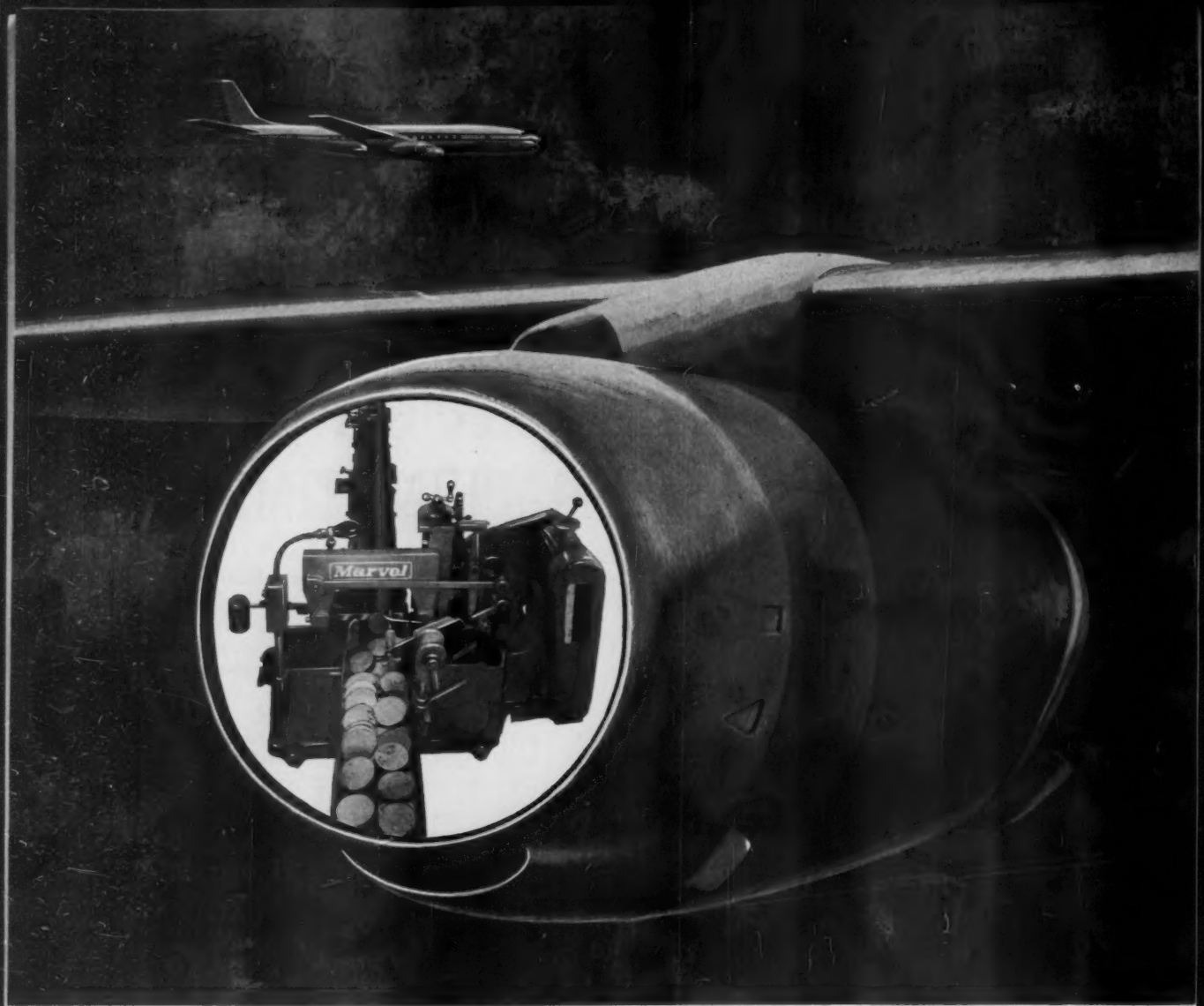


The number of *different* jobs that can be set up on any Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64 page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.



TOO SLOW ?

Emphatically not! . . . ask any visitor to the 1960 Machine Tool Exposition who watched a Marvel No. 6 Hack Saw Machine cut-off 3¼" diameter 1018 steel in 27 seconds! This Saw, costing less than $3000, was actually cutting at the rate of 18 square inches per minute!

We made the above demonstration merely to "match" what we believe to be the impractical demonstrations of some of our competitors. OUR visitors were warned that continuous cutting at this speed is economically impractical if maximum blade life and accuracy (after the first 20 cuts) are desired. They were told that the material could be cut day in and day out, at the rate of 8 square inches per minute with tool cost of approximately 1 cent per cut.

Our point? Marvel No. 6 and No. 9 Series Heavy Duty Ball Bearing Hack Saw Machines, as we build them today, have speed to spare. And they offer the most accurate, economical cut-off at the lowest initial investment.

Ask your Marvel Dealer to arrange a sawing demonstration—on your own work—if you wish. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, you will get an unbiased recommendation.

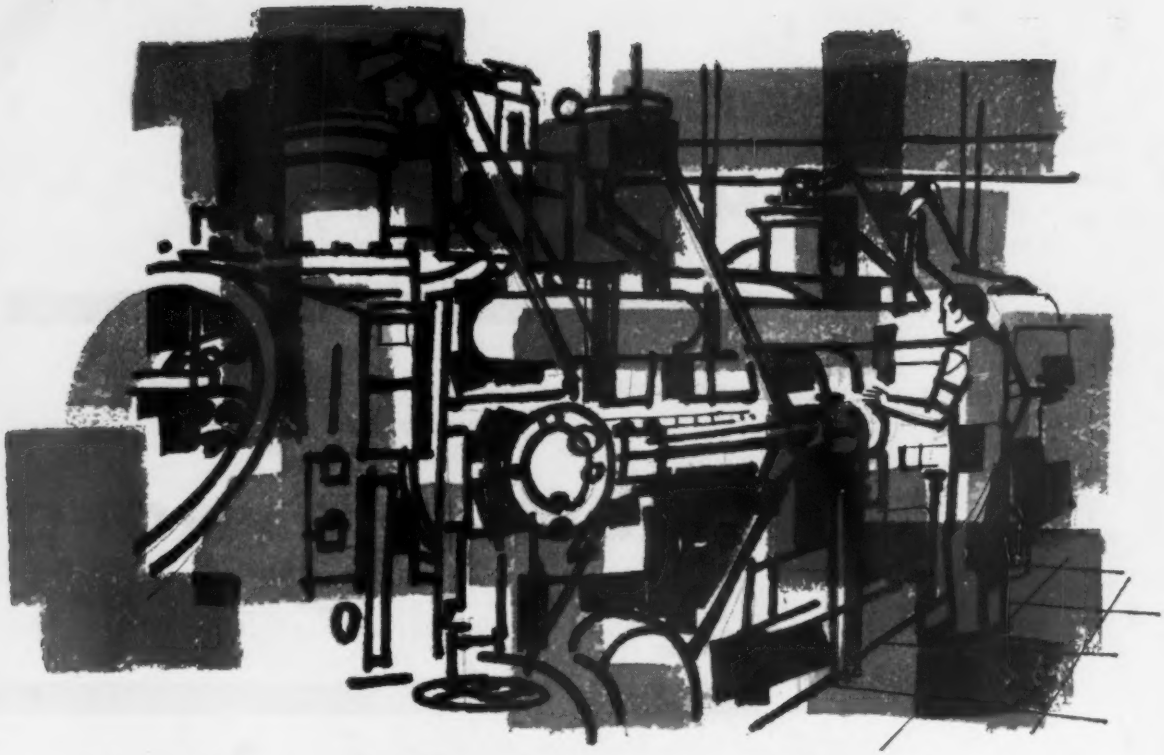
Catalog C60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL *Metal Cutting* **SAWS**

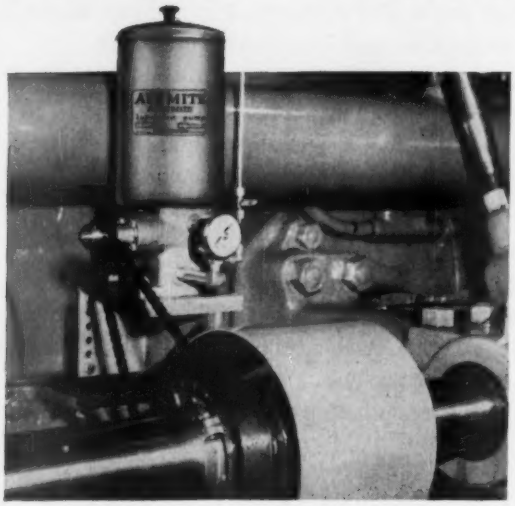
BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

5-1918



No other centralized lubrication system can offer the advantages of Accumite with the ALEMITE MECHANICAL PUMP AND TIMER!



Close-up of the Alemite Mechanical Pump and Timer driven by timing shaft by means of a chain and sprocket.

By utilizing a chain and sprocket to transfer rotary motion to an Alemite Mechanical Pump and Timer you can supply efficient, automatic Accumite Centralized Lubrication to as many as 400 points or bearings. That's over 30 times the capacity of other pumps! The Alemite Pump eliminates the "rat's nest" of lines other systems require—serves all bearings with a single line. Shots are measured at the bearing, *not at the pump*. Line length is no factor and any size shot from .00055 oz. to .012 oz. or more can be delivered to any point. Two more Alemite advantages are the big capacity 5-pint reservoir and an alarm system assuring accurate, positive lubrication.

The Alemite Pump and Timer is completely mechanical, uses no air or electricity. Cam operated valve closes at intervals determined by the pump input shaft speed to deliver positive, measured amounts of lubricant to each point in the system. Measurement is by piston stroke, wear not a factor, pressures remain constant and can be read on any type gauge.

Contact your local Alemite distributor or write for free illustrated literature on the Alemite Mechanical Pump and Timer and the Accumite Centralized Lubrication System.

Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION

Dept. C-101, 1850 Diversey Parkway, Chicago 14, Illinois

In Canada: Stewart-Warner Corporation of Canada, Ltd., Belleville, Ontario

◄ CIRCLE 315 READER SERVICE CARD

CIRCLE 316 READER SERVICE CARD

American Machinist / *Metalworking Manufacturing*

Announces the publication of an important and significant special report

"How to

PROVE THE PROFIT

in Numerical Control"

The principal editorial feature of the October 30, 1961 issue

NUMERICAL CONTROL COME

NUMERICAL CONTROL HAS COME OF AGE—Today, numerically controlled equipment is proving itself practical in many actual in-plant applications. Much has been written about numerical control since it was first introduced. Thousands of pages have been published to explain N/C techniques, developments, and new applications. The first article on N/C in a metalworking publication was an American Machinist Special Report in 1954, "Numerical Control, What It Means to Metalworking." American Machinist/Metalworking Manufacturing probably has published more on N/C than any other magazine.
Now there is a new need to be satisfied.

Numerical-control equipment represents a substantial capital investment. In spite of numerous satisfied users, and many obvious cost savings inherent in this control concept, many specific questions about its purchase and employment in manufacturing are puzzling potential purchasers:

1. How do we justify the initial cost?
2. How soon will N/C pay off?
3. Is labor cost the major saving?
4. Does N/C fit our production?
5. What types of equipment are available with N/C?
6. What machine tools and systems are in practical production?
7. How long can I avoid buying N/C equipment?
8. What are the characteristics of different N/C systems?

American Machinist/Metalworking Manufacturing will devote the major portion of the editorial content of its *October 30, 1961 issue* to answering these and related questions. This report, the first such in-depth effort on the part of any publication, will give the readers sound economic justification for the purchase and employment of numerical control. And it will prove success by example. Such business journalism is possible only with the editorial and technical resources of AM/MM.

This factual, easy-to-use 32-page compilation will consist of two major sections:

1. How to select numerically controlled equipment, and
2. How to justify your investment in numerical control.

I. Selection of numerically controlled equipment will consider such topics as:

A. How to review existing manufacturing facilities.
B. How the product-line influences manufacturing requirements.
C. Special machines as a limiting factor in design change.
D. Can construction costs be avoided by eliminating equipment?
E. How much numerical control is needed for effective use?

S OF AGE

An important part of this section will be a comprehensive fold-out presentation of technical characteristics and operational data, plus applications, for most of the numerically controlled machine tools and numerical-control systems currently available. This much comparative detail is not presently available in any form.

II. Economic justification of numerically controlled equipment will discuss:

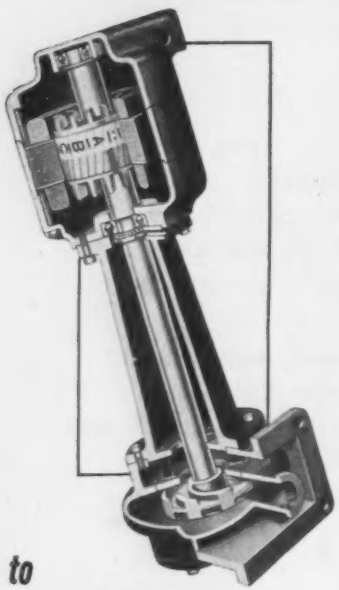
A. The influence of numerical control on the *total plant economy.*
B. The problem of evaluating intangible benefits.
C. Analysis of each of the major areas of savings with N/C. Tooling, lead time, inventory, floor space, labor, scrap, etc.
D. How to develop useful cost data.
E. How numerical control differs from conventional manufacturing methods.
F. How equipment investment formulas can be helpful.
G. How to finance the purchase.

Outlining sources of funds, including the latest information on conditional sales methods and leasing programs. Discussing the proposition that possession, not ownership, produces the profit. To illustrate by example, this section will contain a substantial number of case histories of numerically controlled machines proving themselves in production.

At this time, when so many manufacturing men are beginning to recognize, and evaluate, this dynamic change in their business lives, this issue of AM/MM should have considerable impact.

Gusher

Coolant Pumps are PRECISION BUILT



to

• LAST LONGER
• PERFORM BETTER
ON YOUR MACHINES

You get better performance from your GUSHER Coolant Pumps because they are precision built. The one piece shaft in GUSHER Pumps is electronically balanced to cut vibration to a minimum. Ball bearings are pre-lubricated, no seal or packing needed. Write for catalog.

THE Ruthman MACHINERY CO.

• COOLANT PUMPS
• CIRCULATORS • AGITATORS
• MOLTEN METAL PUMPS

1819 Reading Road • Cincinnati 2, Ohio

LETTER from the PUBLISHER

The Role Of Advertising

I am sure you read AMERICAN MACHINIST/METALWORKING MANUFACTURING because it gives you information you want and need. This is primarily technical. You also pick up important facts from the news and trends pages. Have you ever paused to think about the role advertising plays in your information gathering?

Editorial begets advertising . . .

Our editorial pages deal with the technology of "How to do it." The advertising, however, plays a unique role. It gives you an opportunity to compare "What to do it with." The editorial content of a technical publication in metalworking manufacturing reports on new and improved techniques and methods. If it does an outstanding job of this, it draws to it advertisers of good products.

In effect, competent reporting on new developments in metalworking manufacturing begets advertising from companies who lead in developing products that contribute to more efficient production and, thus, lower your manufacturing costs.

Only half a business paper . . .

While we know that your main reason for reading AM/MM is because it reports on new developments in manufacturing, we also know that the advertising we carry is an inseparable part of your interest in what we have to report. You read advertising because only in this way can you keep fully abreast of the new machines, materials and components you need to know about to keep your plant producing at a profit.

Continue to read advertising with an inquiring and critical mind. And remember, without reliable, informative advertising from firms of high reputation and stature, your business paper would be only half a business paper.

George Reppert

Steel
for Strength
. . . Economy
. . . Versatility

Tool Steel Topics

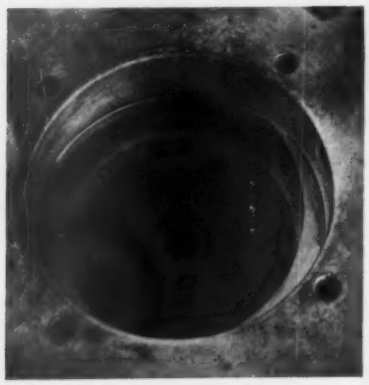
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Seals for jet engine starter cartridges blanked with Lehigh H

The job was tricky. It involved cutting 6-in. circles from .002 in. Mylar, a plastic material used for vapor seals in jet engine starter cartridge parts because of its high strength and resistance to tearing. Bethlehem Lehigh H tool steel was selected by Seymour Manufacturing Co., Seymour, Indiana, who designed and built the die for Amoco Chemicals Corp. Lehigh H was a wise choice. The die, made to extremely close tolerances, blanked the material cleanly, and produced nearly 140,000 pieces before slight redressing was required.

Lehigh H (AISI D-2) is our easy-machining high-carbon, high-chrome grade of air-hardening tool steel. It has high compressive strength, deep hardenability, and excellent resistance to wear.



Lehigh H has wide range of metal working uses

Because of its ideal properties, Lehigh H is used for blanking, forming, punching, shearing, bending, and other tool and die jobs. It's frequently used for rotary slitting cutters, wearing plates, and thread-roller dies.

Good things happen when you put Lehigh H on the job. Your local Bethlehem tool steel distributor can make prompt delivery.

Call him today for complete details.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

"Wear-In" of Tools Must Be Handled with Care

The initial use of new tools is the most critical period of operation. For example, during the "wear-in" period, the working surfaces of a drawing die and its mating punch may gall or "pick-up" portions of the metal being formed. This condition must be detected soon after it occurs, then removed promptly by hand stoning, to prevent further surface damage to the tools. If it is not detected and removed, heavy scoring and seizing may occur, producing not only short tool life but defective parts as well.

Obviously, the use of an effective lubricant will decrease "wear-in" problems, but even the best lubrication practice may not be sufficient protection on many operations. For example, a combination of tools and lubricant which performs well in processing soft steel may be troublesome in working stainless stock. Close attention to such tools during "wear-in" will delay the "wear-out" period.

Air-4 Tool Steel Machines with Ease. Bethlehem Air-4 is a medium-alloy tool steel which hardens in air at 1550 F. It has excellent free-machining characteristics, due to a carefully controlled addition of lead. Air-4 also has plenty of wear-resistance, toughness, and deep-hardening properties. It can also be heat-treated without running any danger of cracking.

CIRCLE 320 READER SERVICE CARD

KEYWAY BROACH KITS • SQUARE BROACHES • ROUND BROACHES • PRODUCTION TYPE BROACHES • SPECIAL BROACHES • HEXAGONAL BROACHES • duMONT TOOL BITS • MINUTE MAN® MAGNETIC BASES • MINUTE MAN®

We cut Keyway cutting costs 75% with a Minute Man® KEYWAY BROACH KIT

Before Minute Man® we had to set up big machine tools to cut keyways. No more. With the Minute Man Keyway Broach Kit, and an arbor press, we cut keyways by hand in one minute for as little as one cent a keyway. Any standard size from 1/16" to 1" in any bore from 1/4" to 3".

Special and stock square, round, hexagonal and Production Type Keyway Broaches will also save time and money. Send the coupon for complete details.

(A) (B) (C)

Minute Man®

(A) SQUARE BROACHES
For finishing 1/8" to 1" square holes in one pass in cast or drilled bore. (32nd sizes, too)

(B) HEXAGON BROACHES
For finishing 1/8" to 1/4" hexagon holes in one pass in cast or drilled bore.

(C) ROUND BROACHES
For finishing 1/4" to 1" round holes in one pass in drilled bore.

The duMont Corp., Greenfield, Mass.
MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....
Company.....
Address.....

duMont

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Less Concrete Under Machine

Dear Sirs:
I just read your article entitled "Flat within tenths — by MILLING" (*AM/MM* — July 10 '61 p85). The article says that DeVlieg Machine Co used an 8-foot-deep concrete base to insure rigidity.

For your information, Revere Copper & Brass Co has just installed a 48 by 144-inch surface-finishing machine on a slab of concrete, 28 by 9 feet by only 13 inches deep, which in turn was poured on a ½inch pad of Keldur vibration isolation material. Machine and slab weigh 60,000 lb.

C D Quimby
Keldur Div of Quimby & Co
Chester, NJ

The Minuteman's Shell

Dear Sirs:
Having read and discussed the article "Building the Minuteman's Shell" (*AM/MM* — Aug 21 '61, p95) with a number of our executives, we feel it is appropriate to commend you and your staff for an excellent treatment of an interesting manufacturing development.

The article was clear and concise and thoroughly explains the manufacturing process as we know it, with fair treatment given to each machinery manufacturer involved. Furthermore, it was quite timely because of the renewed interest in rockets and missiles.

We are looking forward to future articles which will be as ably reported as this story.

W Dolle, Jr
Assistant to the President
The Lodge & Shipley Co
Cincinnati, Ohio

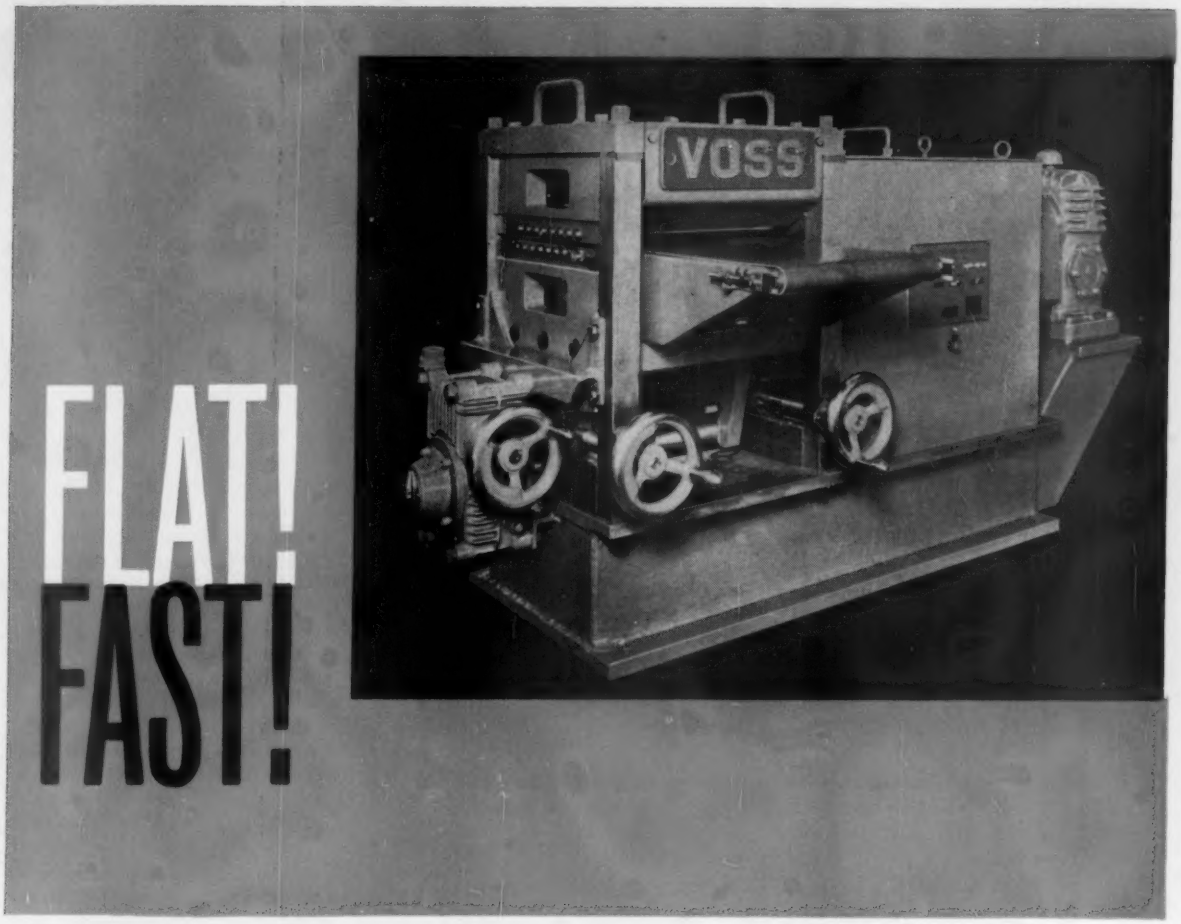
Time for Typing Practice

Dear Sirs:
I am puzzled by the item on your Contents page (*AM/MM*—Sept 18 '61, p1) concerning honeycomb brazing. Do you mean General Dynamics/Fort Worth or General Dynamics/Forthwith.

Then, on page 123, you have a "flashback" to: (*AM/MM*—Oct 31 '61, p 86). You haven't already

SHOPMATES

N. Jarvis



FLAT! FAST!

THAT'S THE STORY OF THE NEW VOSS STAMPED PARTS-FLATTENER

Stamped parts are flattened to .005 of dead flatness *in one pass!* Hand or automatic feed. Heavy duty, low maintenance. Takes no more space than your desk. Can be engineered to flatten parts with irregular surfaces. Savings in time and manpower can be enormous. Low cost for the job it does. If you're looking for cost reduction in your stamped parts operation, call or write Voss Engineering Company.

We'll be glad to arrange a demonstration with your parts, without obligation.

Voss ENGINEERING CO.

7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)

SOSSNER *Introduces* Improved Tap Identification

Only SOSSNER TAP PACKAGES GIVE YOU

- Complete Specifications in LARGE, CLEAR PRINT
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- Separate label for surface treatment
- Label Color Coded for each GH limit

Write us for samples of SOSSNER labels and for information about the unique PERFORMANCE features of SOSSNER Taps.

Sold Through Industrial Distributors

SOSSNER
TAP & TOOL CORPORATION
27 Broadway, Lynbrook, L.I., N.Y.

Mail This Coupon for Further Information

T. T. Sossner, President
Sossner Tap and Tool Corp.
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Send, without obligation, further information on items checked . . .

- ☐ Sossner Triple Tempering Story
- ☐ "elektraLUBE" Taps (self lubricated)
- ☐ Special Trial Test Sheets

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

STT-19-MI

published an October 31 issue this year, have you?

Bart Singer
New York, NY

The type gremlins must have had it in for GD/FW. We intended to say Fort Worth, of course, not Forth Worth.

And the earlier article on the Company's single-platen brazing process was in 1960. The correct reference is (AM/MM—*Oct 31 '60, p86*)—Ed.

Dispel the Fog

Dear Sirs,

Your editorial, "Time to Dispel the Fog" (*AM/MM*—Aug 21 61, p93), concerns a matter which is of extreme importance and urgency to the American people. It should be brought to the immediate attention of members of the executive and legislative branches of our government.

Would it be possible to obtain a small number of reprints of this editorial? I should like to send a few of them to my representatives in the House and the Senate.

Herbert W Hasselkus
Milwaukee, Wis

Pointing out that the government has greatly expanded defense spending, the editorial questioned whether "Washington knows what industry's capability is for making the newest weapons . . . At the moment it is difficult if not impossible to find out what the defense production score is." Copies of the editorial were recently entered in the Congressional Record *by Senator Lausche and Congresswoman Bolton of Ohio*—Ed.

"Just a couple more chapters and I'll get started on it!"

CALENDAR

American Institute of Mining, Metallurgical & Petroleum Engineers — Metallurgical Society Fall Meeting, Oct 23-26, Pick Fort Shelby Hotel, Detroit

American Society for Metals — National Metal Exposition and Congress, Oct 23-27, Cobo Hall, Detroit, Mich.

Society for Nondestructive Testing — Annual Convention, Oct 23-27, Henrose Hotel, Detroit.

National Tool & Die Manufacturers Association — Annual Convention, Oct 25-29, Huntington-Sheraton Hotel, Pasadena, Calif.

American Gear Manufacturers Association — Semi-annual Meeting, Oct 29-Nov 1, Edgewater Beach Hotel, Chicago, Ill.

Industrial Management Society— Industrial Engineering and Management Clinic, Nov 1-2, Pick-Congress Hotel, Chicago.

National Electrical Manufacturers Association — Annual Meeting, Nov 16, Plaza Hotel, New York.

American Society of Mechanical Engineers — Winter Annual Meeting, Nov 26-Dec 1, Statler Hilton Hotel, New York, NY.

Society of Automotive Engineers —Annual Meeting and Display, Jan 8-12, Cobo Hall and Convention Arena, Detroit, Mich.

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Statler Hilton Hotel, Washington, DC.

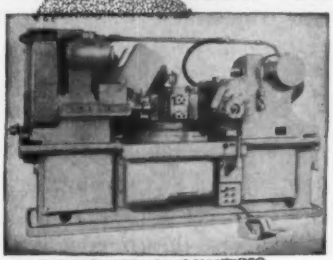
Society of Plastics Engineers — Annual Technical Conference, Jan 30-Feb 2, Penn-Sheraton Hotel, Pittsburgh, Pa

Material Handling Institute — Spring Meeting, Feb 6-8, Hilton Inn, Atlanta, Ga.

American Society for Metals — Golden Gate Metals Conference, Feb 15-17, Fairmont Hotel, San Francisco, Calif.

Society of Automotive Engineers —National Automobile and Production Meeting, Mar 12-16, The Sheraton Cadillac, Detroit, Mich.

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore, it means *more* finished pieces in a given period of time and greater accuracy in every finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

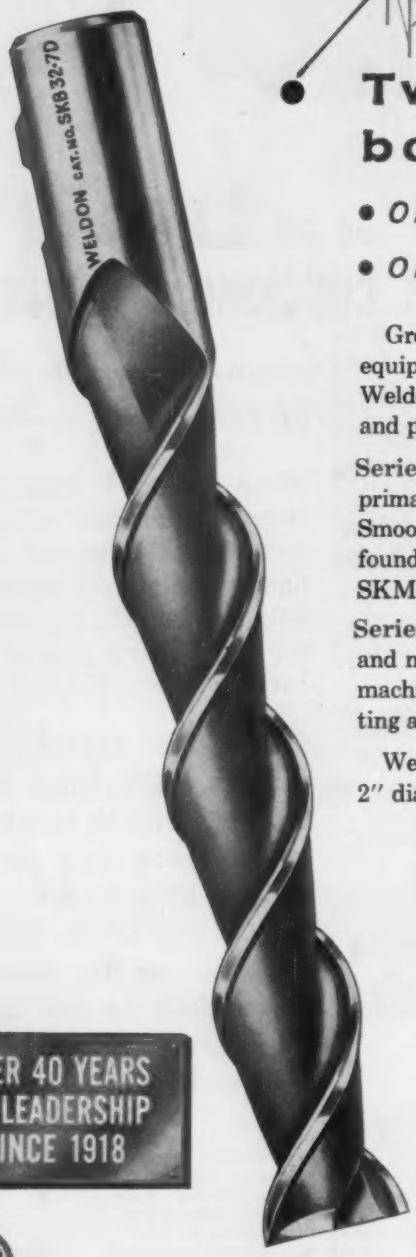
Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

WELDON *Ski-Kut* END MILLS

PATENTED



Two *Ski-Kut* styles both for ALUMINUM

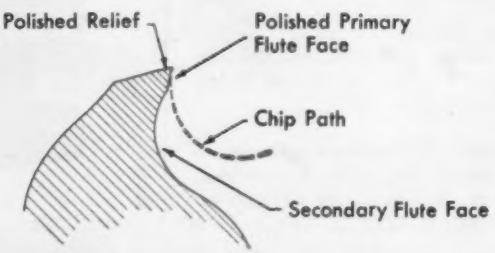
- *one for roughing*
- *one for profile finishing*

Greater feeds, longer tool life, better finish, easier operation of equipment are some of the cost-cutting benefits you get when you use Weldon's patented SKI-KUT End Mills featuring a 45° helix angle and polished chip take-off land for smoother, faster shearing action.

Series SKB — Designed for heavier stock removal, the polished primary flute face and polished relief minimize adherence of chips. Smoother shearing action minimizes the hammering effect often found in 2-flute mills with slower helix angles. Write for BULLETIN SKM-1.

Series SKX — Especially designed for profile finishing of aluminum and most non-ferrous metals. Ideal for tape-controlled and tracing machine operations, these Weldon SKX end mills provide quiet cutting and chatter-free work finishes. Write for BULLETIN SKX-10.

Weldon SKI-KUT End Mills are available from stock in ¼" to 2" diameters and various flute lengths.



OVER 40 YEARS OF LEADERSHIP SINCE 1918

Minimizes adherence of chips
Increased Shearing Action (45° helix angle)
Hammering Effect Minimized • Longer Tool Life
Greater Feeds • Better Finish • Easier Operation

THE WELDON TOOL COMPANY

3000 Woodhill Road • Cleveland 4, Ohio

Weldon Distributors throughout U.S.A. and Canada carry complete stocks to serve you.

A-6214A

He's making a Monarch Lathe...

This might be your Monarch Machinability Test Lathe establishing optimum cutting conditions on a difficult turning job. Data is immediately applicable to production conditions.

One example of where the extra values come from—in your MONARCH Lathes

"Building" a lathe? Looks more like "operating" one! Actually this Monarch metallurgical engineer is doing both. You see, that's a Monarch Machinability Test Lathe running one of the thousands of tests that constitute our continuing long-range metal-cutting research program.

Here's where we dig for gold in the chip pan; where we get the answers to all questions posed by the color, size and shape of the chips. Questions like: Is too much heat generated, causing short tool life and work distortion? Is speed too low, with resultant production loss? Is rated horsepower of the machine too low for expected metal removal? Is work finish unsatisfactory? Or in one over-all question, is the inbuilt productiveness of the machine being realized on every cut?

Monarch Lathe design benefits directly, and continually from data so developed. Too, Monarch users find here the answers to knotty problems. Additionally, such data tabulated in our booklet "Speeds and Feeds for Better Turning Results" has become a "must" reference for the whole field of metal turning.

Yes, this man is building Monarch lathes . . . in terms of more profitable performance for every user. THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

WHEN YOU BUY VALUE
MONARCHS COST LESS

Monarch
TURNING MACHINES

VISIT MONARCH—*We'll turn your part to return you profit*

NOW 3-AXIS NUMERICAL CONTROLS FOR B&S TURRET DRILLS

HUGHES 3-AXIS NUMERICAL CONTROLS are now available as original equipment on Brown & Sharpe turret drills. With 3-Axis control, operation is completely automated—more work at less cost. Each spindle can be programmed for multiple drill depths. Feed speeds are tape controlled. Set-up time is reduced more than sixty per cent. And—as with all Hughes Numerical Controls—jigs, fixtures and templates are eliminated. Fitting 3-Axis controls to B & S turret drills is another "first" for Hughes. And you get proven reliability through Hughes' long experience in numerical controls. Hughes' transistorized circuitry, modular construction, and photo-electric tape readers mean more "up-time," increased production and less maintenance. Hughes ULTRA-RELIABILITY adds up where it counts—in your profits.

SPECIFICATION SUMMARY

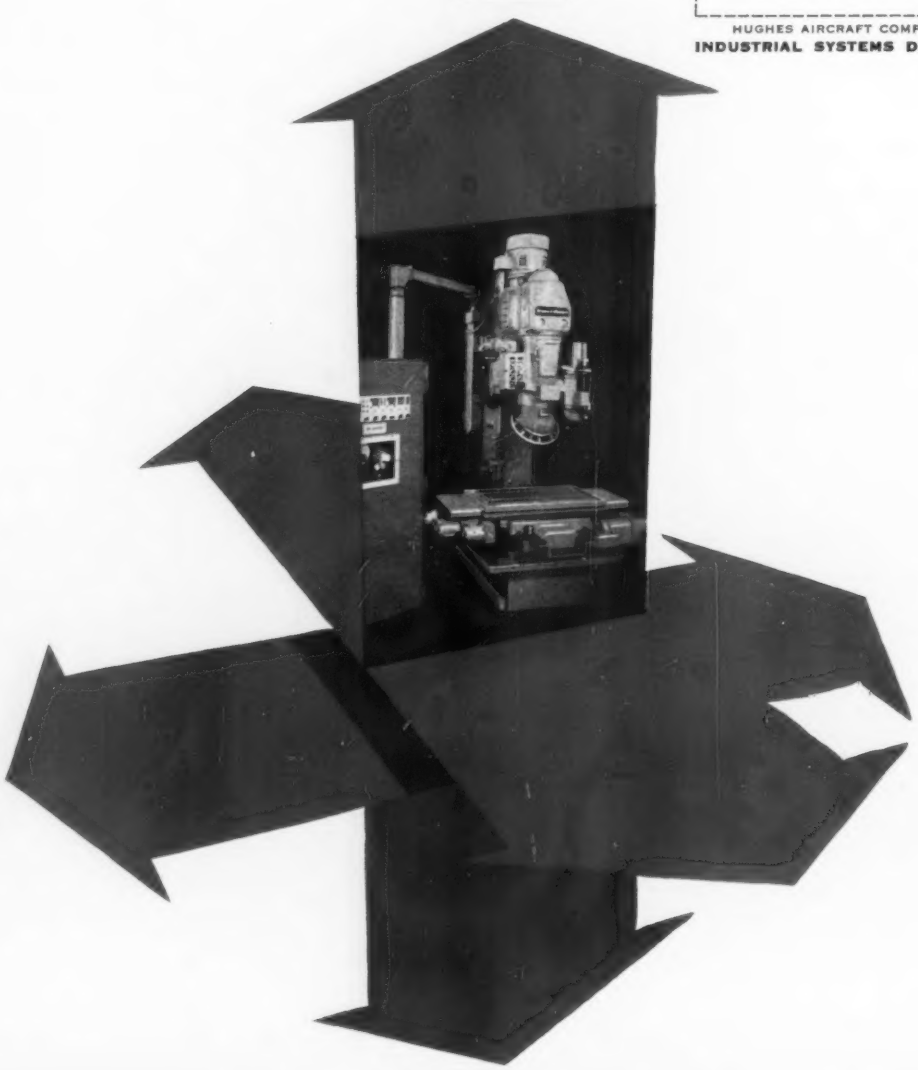
Axis controlled	X	Y	Z
Range of movement	20"	15"	9"
Accuracy	±0.001/ft.	±0.001/ft.	±0.002/ft.
Repeatability	±0.0002/ft.	±0.0002/ft.	±0.001/ft.
Position Speed (in./min.)	160"	160"	180"

Find out more about 3-Axis (or 2-Axis) Hughes Numerical Controls. Ask your B&S distributor, or write, wire, teletype (TWX INGL 4117) or call: Hughes Industrial Control Systems, Dept. No. 92-21, P.O. Box 90904, Los Angeles 45, California.

Creating a new world with electronics

HUGHES

HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION



SPOT NEWS...

- **All rights to develop, manufacture, and sell the Nu-Era** numerically controlled exhaust-pipe bender (*AM/MM*—Feb 8 '60, p102) and the more recently announced N/C aircraft-tubing bender, originally contracted by Nu-Era to the Walter P Hill Co, have been purchased by Baldwin-Lima-Hamilton's Industrial Equipment Division (Philadelphia). B-L-H plans to develop a line of benders for auto, aircraft, architectural, and other OEMs.

- **U S Steel Corp will build a 30,000-tons-a-year stainless steel mill** at Terni, Italy, in cooperation with an overseas firm. Mill, expected to begin operations in late 1963, will feed bulk of its production into the European Common Market. This is U S Steel's first overseas production venture.

- **National Institute of Jig and Fixture Component Manufacturers** has decided upon dimensions for Institute standards for quarter-turn screws and rest buttons. This is the first step in the establishment of industry standards for all important jig and fixture components. Dimensions and sketches may be obtained from George S Eaton, executive secretary of the Institute, at 1658 Victoria Ave, Lakewood 7, Ohio.

- **Machine design and manufacturing engineering services** are being offered to industry on an hourly or contract basis by Motch & Merryweather Machinery Co's Design Development Engineering Division, 1250 East 222 St, Cleveland, Ohio. Cost of the service is said to be equal to or less than that charged by most engineering service organizations.

- **An electro-hydraulic (underwater spark discharge) forming machine** that is said to operate off common 110-volt house current has been developed by Electro-Hydraulics, Inc, Dallas and Fort Worth, Texas. Unit, with its 15,000-joule capacitor bank, is capable of expanding tubular parts 10 in. in dia and four feet long, and flat sheet parts up to 196 sq in.

- **A British press builder is expected to start building Dynapak** high-energy-rate forming machines in the near future. Signing of a manufacturing agreement with General Dynamics will be announced shortly, say British sources.

- **Services and facilities of research organizations in the nation's capital** are listed in a 72-page publication available from the Science Bureau of the Metropolitan Washington Board of Trade. Publication lists nearly 200 R&D firms, plus government and related agencies. Price: $2.

- **Many European machine tool builders are orienting their sales programs** toward the Middle East and Far East. India is attracting more attention; so is Japan. The British Machine Tool Trades Association is sponsoring a British builders' exhibit at the Machine Tool Show scheduled for September 1962 in Tokyo.

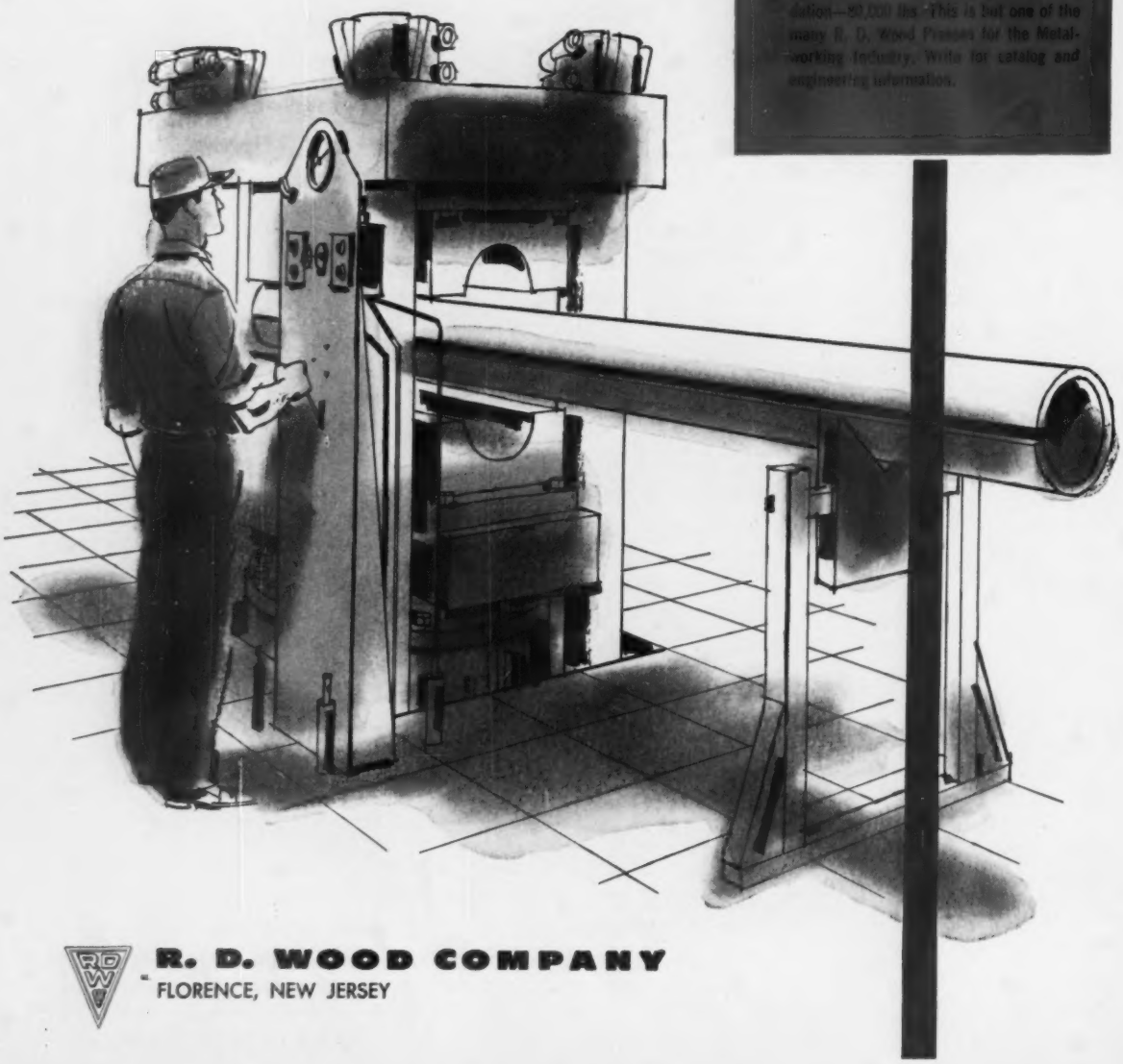
- **Saginaw Bearing Co (Detroit) is testing lead-bronze sleeve bearings** for use in jet engines, diesel engines, and automotive drive shafts. Key to success in such tough-use applications is lead segregation, where a lead-bronze bearing alloy is centrifugally cast (with induction heating) to a steel backing. Because the lead is not allowed to alloy with the bronze, it forms a bearing layer that will withstand high pressure at temperatures to 750 F.

- **Efforts to get a one-version jet fighter for military use may be snagged.** When aircraft companies were asked to bid, they found that the Navy wants a short-range, 6000-lb-bomb capacity fighter 56-ft long for aircraft-carrier use, while the Air Force wants a 73-ft-long plane that can carry a lighter payload for longer distances.

You can design your own press at R. D. Wood

Working with numerous basic models, R. D. Wood engineers incorporate your specifications and modifications to produce the press exactly suited to your needs. You can be sure of its quality, too. For every Wood Press is constructed of selected materials by master craftsmen. This is your warranty of dependable performance and precise operation. Why not consult us when planning your next hydraulic press?

150 ton R. D. Wood Hydraulic Press for pipe forming operations. Press has self-contained pumping unit. Dies can be replaced for various sizes of pipes ranging from 4" to 12". Floor space, press proper—9' x 6'. Height—13'. Weight on foundation—90,000 lbs. This is but one of the many R. D. Wood Presses for the Metal-working Industry. Write for catalog and engineering information.



R. D. WOOD COMPANY
FLORENCE, NEW JERSEY

WASHINGTON...

Walsh-Healey hearings continue . . .

Labor Department statisticians are grinding out evidence in preparation for new minimum wage rates to be paid by contractors producing both motors and generators and machine tools for the government. In detailed hearings that include industry and labor positions on the proposed change in wage scales, Bureau of Labor Statistics officials have federal findings as support for the new wage figures that will eventually be set by Labor Secretary Arthur Goldberg.

Companies with government contracts over $10,000 must pay the prevailing minimum for their industry under the Walsh-Healey Public Contracts Act. From the core of government evidence, combined with details from industry and union officials, the Labor Secretary will set the new rates.

In the motor and generators hearing, now just under way, BLS studies put the prevailing minimum by "plant" at $1.24, and the minimum by "covered workers" at $1.73.

The National Electrical Manufacturers' Assn attempted to impeach the BLS study as the hearings got under way. NEMA tried to make its own wage study, and became convinced that both its study and the BLS study are worthless. NEMA failed in the hearing to get a subpoena requiring BLS to reveal the individual company reports underlying its statistics.

BLS gathers these reports under a pledge of secrecy but NEMA insists it can show gross inaccuracies because firms misinterpreted the BLS questionnaire.

Hearings on the machine tool industry are now complete—to be followed by written reports by industry and labor on Oct 18. BLS findings in this industry put the prevailing wage at $1.73, with the rate $1.75 for covered workers.

In this case, the National Machine Tool Builders' Association urged a finding between $1.39 and $1.49, while labor officials are seeking a rate of $2.15. The union figure would include 13¢ in increases since BLS made its study and 22¢ for fringe benefits.

Incentive-fee contracts . . .

Higher risks in return for greater profits are in store for defense contractors under a new procurement plan being drawn up at the Pentagon. The revision of procurement regulations, to be announced shortly, involves chiefly substitution of cost-plus-incentive-fee contracts, wherever possible, for cost-plus-fixed-fee awards.

It would work like this: A contractor would be assured of a minimum fee. But this fee could be increased, within specified limits, if he produced for less than the originally estimated cost.

Conversely, the contractor would run the risk of a lower-than-normal rate of profit—even an outright loss—if he exceeded cost estimates or if his performance, in terms of quality or delivery time, was unsatisfactory.

Delays in M-14 rifle output . . .

Speeded production of the fully automatic M-I is called for by the Senate Preparedness Subcommittee. Only recently has the advanced rifle been issued to U S troops in Berlin—some 16 years after the project was started.

The Subcommittee charged "delays, slippages and inefficiencies" on the part of both Army and commercial producers. Criticism was aimed especially at the first two commercial producers —Winchester-Western Division of Olin Mathieson, and Harrington-Richardson, Inc. A new contract was issued last week to Thompson-Ramo-Wooldridge, Inc.

NLRB policy develops . . .

Union leaders have scored an important first victory in the Kennedy administration's National Labor Relations Board with a ruling on the vital "agency shop" clause. A four-member NLRB majority holds that this contract clause —which requires non-union members to pay the equivalent in dues and fees to a union in their plant—is a legal union bargaining demand under the Taft-Hartley Act.

In this test case, General Motors Corp had refused to negotiate an "agency shop" agreement with the United Auto Workers in Indiana on the grounds it would infringe on the rights of workers who refuse to join the union.

The Board's action overturns a previous ruling by the NLRB under the Eisenhower administration. It provides a shot in the arm to labor unions which are turning to the agency shop as a substitute for a union-shop clause that requires union membership to hold a job. Union negotiators often demand the agency shop in "right-to-work" states where compulsory unionism is outlawed.

Labor proponents claim this contract device eliminates "free riders" — non-union workers covered by union contracts. Opponents charge the agency shop is another means of forcing workers into a union, either against their will or against state laws.

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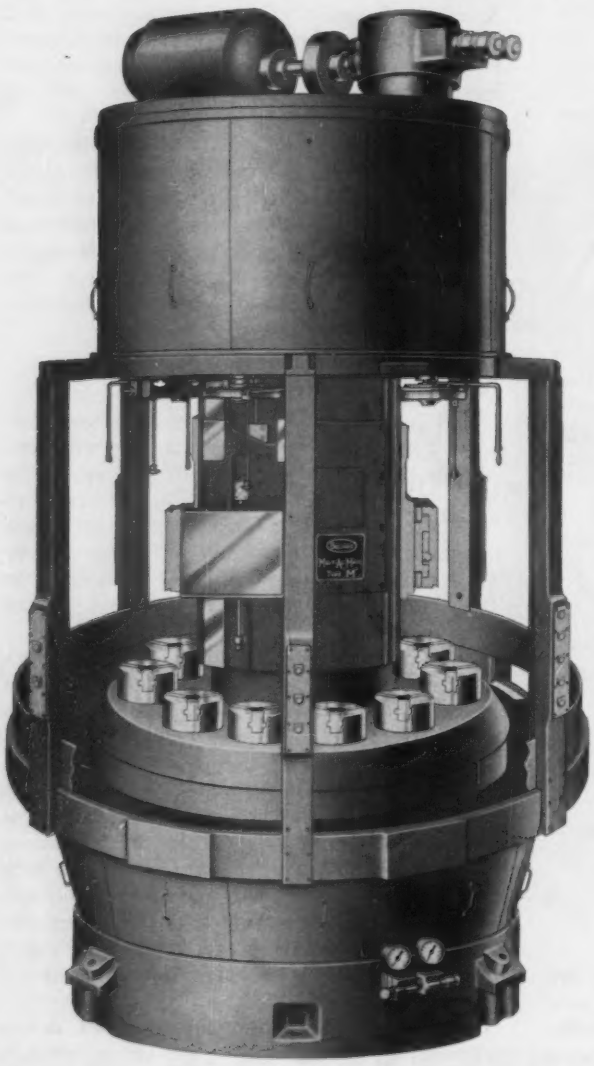

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DETROIT...

Output heads up again...

GM's low point was just after mid-September, when the full effect of the strike cut auto assemblies down to an 8,000-car total for the weeks of September 16 and 23 combined. But the last week in September saw production up again, at 80% of the going-at-full-blast rate established a month before.

What the strike cost GM in cars (not counting dollars wasted) probably adds up to around 120,000 units, because the giant producer was turning out 51,000 per week just before the strike.

Ford had leveled off by late September at close to 40,000 cars per week, a rate that would produce nearly 2 million assemblies in a year, but which was aimed at filling dealer inventories and handling the early rush of orders when the model year is new.

Chrysler production has built up more slowly, and now runs a bit over 20,000 per week. Checker Motors had a spurt recently, jumping from a normal 100 units per week to 145 in one week. Rambler has been climbing very slowly, up to almost 10,000 per week by the end of September.

Bucket seats and horsepower...

Success of the bucket-seat brigade (Corvair Monza, Falcon Futura, etc.) seems to have rubbed off on the higher-powered engine options in the compacts. It's not really a horsepower race; it's more likely the trend created by the small luxury models, where option buyers figure they might as well get the works while they're at it. Some of the higher-powered engines involve so little money that they are often thrown in to clinch a deal.

In Corvairs, for example, some 25% of the cars sold in '61 had more-than-standard power; either the 84-hp standard in the Monza model (attained with a 9:1 compression ratio instead of the standard 8:1) or the 102-hp option available at $27 on any Corvair (which involves the 9:1 ratio, a special camshaft, and special exhaust system).

Falcon sold 34% with 170-cu-in. engines at 101 hp, instead of the standard 144-cu-in. engine at 85 hp, at a list price increase of $37. In the Comet, where the option costs $45, 53% were sold with the larger engine.

Valiant and Lancer sold only 4.2% and 14.1% bigger engines, respectively, in '61—the 225-cu-in. version of the slant six at a premium of $44. A contributing cause may have been the lack of a fancy bucket-seat model. However, the standard 170-cu-in. engine at 101 hp is completely adequate, and the same car with the optional 145-hp engine is considered the hottest of the compacts (particularly with the '61 floor shift, which is not now available).

Rambler's Classic has the aluminum-engine option, but the difference in power is only 127 vs 125 hp. The total percentage sold was 38.5%; but the aluminum engine is standard in the top Classic line (24.4%), so out of the Classic total, some 14% of the cars sold included the aluminum engine as a specified option—at $30 more.

Corrosion stopper...

At last there seems to be a good answer to the auto-body rust problem: a heavy-body grease with seven inhibitors added. Michigan Bell Telephone recently described the material after extensive field tests on its company fleet of 4600 cars and trucks. Main advantage of the material, which was originally developed to protect gas and oil pipelines, is its ability to creep with capillary action over uncoated areas until it eventually forms a uniform protective coating. Thus it will reflow over a spot struck by a stone, and will cover all areas inside a door panel even if the original spray job did not hit all surfaces.

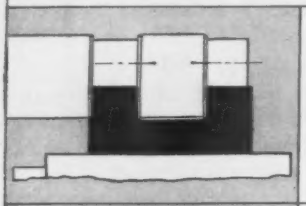
The creeping ability remains, because the material stays soft under a skin that forms in air. The inhibitors in the material will protect any metal surface, even if most of the material gets scraped away. It will not flash if a body panel has to be welded, and new material applied over the weld will protect just as well as the original coating.

One criticism of undercoating has been that the standard material, once punctured by a flying stone, tends to trap moisture next to the metal panel. And this makes corrosion more likely than if the metal were not coated. The galvanized coatings and extra paint dips being applied to many current-model cars are evidence that regular undercoatings aren't enough.

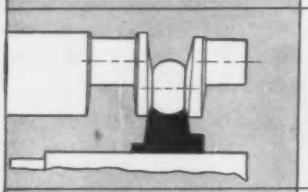
According to Michigan Bell, a good job with the new material (Texaco Compound L—which will soon have competition from other oil companies) requires about $3,000 in equipment, plus $25 to $30 in materials and labor per car. Whether this can be translated into a production job for automobiles at a reasonable price is still an open question.

Eccentric Forming on Greenlee Automatic Bar Machines

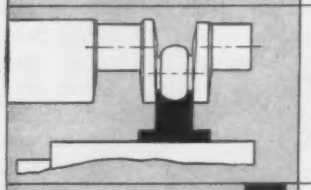
MACHINE . . . 1-5/8" — 6 Automatic Bar Machine
TOOLING . . . High Speed Steel
MATERIAL . . . B1112
STOCK SIZE . . . 1" round
TOOL SLIDE STROKE . . . 1-3/16" at .0042" feed
SPINDLE SPEED . . . 420 rpm 110 sfm
MACHINE TIME . . . 43 seconds
ESTIMATED GROSS PRODUCTION . . . 83 per hour



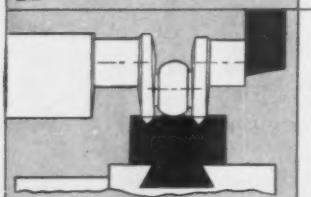
1. Rough eccentric form .550" diameter and 1/32" radius.



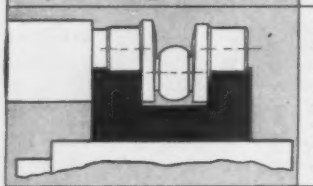
2. Rough eccentric form .643" spherical diameter, finish form inside tapered sides, and 1/32" radius.



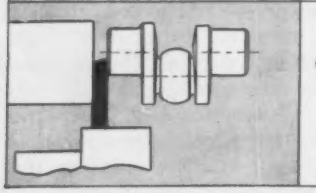
3. Finish eccentric form .643" spherical diameter and .023" radii.



4. Face end. Break corners on 1" diameters.



5. Finish eccentric form .550" diameter, outside tapered sides, 1/64" radii, chamfer 45° on ends, and break-down for cutoff.



6. Cut off.

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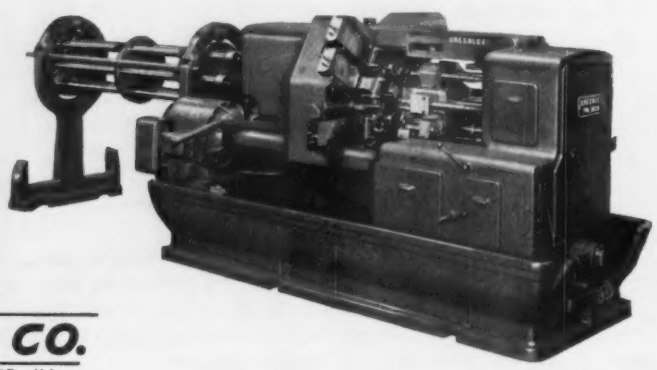

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AIRCRAFT and MISSILES...

TRENDS

Proposed changes in procurement...

Procurement recommendations on many controversial issues have been sent to the Pentagon by an industry advisory committee set up by Senator George Smathers (D, Fla), who is chairman of a procurement subcommittee of the House Small Business Committee.

The chairman of the Military Procurement Advisory Committee is Carl G. Hokanson, president of a West Coast air conditioning equipment firm.

The recommendations call for an end to the Renegotiation Act, which is due to expire this summer; changes in advertised vs negotiated bidding; changes in make-or-buy regulations; and the like.

Pentagon officials haven't had anything to say yet about the report. Defense Secretary McNamara has many programs underway to improve procurement practices.

A new law requires the Pentagon, GSA, and the Small Business Administration to come up with a new small business subcontracting program within 90 days. The aim: Give SBA some more leverage in forcing the military to place more contracts with small primes and small subs.

Lockheed to buy new machines...

The Lockheed-Georgia Co. (Marietta, Ga)—officially designated Air Force Plant No. 6—has just been awarded a $3.7 million contract under the Air Force's Machine Tool Modernization Program.

According to a Lockheed official, funds from the new contract will be used "primarily for purchases and installation of numerically and electronically controlled metalworking machinery to be used in fabricating parts for the C-141 jet cargo and troop carrier."

This is the Georgia plant's second Air Force contract for tool modernization in the past few weeks. The previous contract was for $3.2 million, which will be used for updating the machine tools used in the various C-130 fabrication programs.

Air Force to use PERT...

PERT management control systems, developed for the Navy's Polaris missile system, is now being used by the Air Force for the Titan II, Minuteman, and Skybolt missile programs, and for the production phases of the Titan I and Atlas missiles and the B-70 and F-105 aircraft programs.

PERT (Program Evaluation and Review Technique) is based on the idea that the time needed for an entire project depends upon the sum of the times needed for certain essential jobs within the project. By concentrating on these jobs, a contractor should be able to chalk up considerable time and cost savings.

Rear Admiral William F. Raborn, head of the Special Projects Office of the Navy, has been the chief promoter for PERT. It is reported that his insistence on using this technique for scheduling the Polaris program (missile and sub) was responsible for this weapons project being completed two years ahead of schedule.

This scheduling system will also be applied by the Air Force to the C-141 jet transport and the TFX tactical fighter programs and, eventually, to all major USAF system procurement.

Lockheed's purchasing system...

Lockheed Missiles & Space Co, prime contractor for the Polaris, Discoverer, Midas, and other aerospace programs, has been granted the authority to issue fixed-price purchase orders and subcontracts up to $10,000, without prior approval of the governmental agency concerned.

Formerly, $25,000 was the maximum allowed for such purchase orders and subcontract work.

A recent survey of aerospace company purchasing procedures and methods—conducted by the Air Force, Army, Navy, and NASA—revealed that Lockheed's system contained the necessary checks, balances, and controls utilized by federal purchasing agencies to assure the fullest possible return for defense and space expenditures.

The new, higher figure should speed delivery of parts, materiel, and subcontracted components, says Lockheed. These orders add up to a considerable sum, for Lockheed spends more than 50% of its contract income with outside companies. Many of these firms are in the small business category, and many are located in distressed labor areas.

Common stockpile of plane parts...

The financially pressed domestic trunk airlines are interested in setting up a common stockpile of airplane parts to cut purchasing costs.

The idea was presented informally to the Civil Aeronautics Board, which would have to approve such a step at a meeting between CAB members and presidents of the major airlines.

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GEAR-MAKERS TO LEADING MANUFACTURERS

MACHINE TOOLS...

Services keeping surplus tools . . .

Government surplus machine tools no longer are coming on the market as they were. In fact, surplus sales are drying up. The worry about the effect of surplus tools on the commercial market has just about halted.

The Berlin crisis is partly responsible. But even more to the point, the administration's emphasis on building up a potential for conventional warfare has led to a policy by the armed services of conserving the machines they own.

Machine tools had virtually no place in the concept of all-out nuclear warfare and nothing else. But they are almighty important in conventional warfare. Hence the sudden renewed interest in preserving what the government now has.

The current crisis also seems to be stimulating the need for getting at an up-to-date appraisal of machine tool requirements for the over-all mobilization base.

There also is some discussion of the so-called "trigger program" whereby instructions would go out from Washington for machine tool builders to begin production on orders already signed and sealed for defense needs. The feeling in some circles is that the trigger program is not comprehensive enough. As it is now, it covers only 89 builders of metal-cutting type machines. It should embrace more builders, the argument runs, and should take in metal-forming as well as metal-cutting machines.

European orders shrinking . . .

Orders of western European machine tool builders are beginning to shrink, though they still are at a very high level. One good explanation is that the buyer has little incentive to buy if he cannot get delivery for from 12 to 24 months or longer. If he must have new machines, he places his business where he can count on earlier deliveries, such as with U S builders.

More than that, some West German builders are reported to have received sizable holdups or cancellations from automobile companies. This action is not viewed as alarming, but it supports the belief that the automobile industry perhaps has been expanding a little too fast and needs to catch its breath.

Incoming orders of British builders are not so uniformly good as they were, with business excellent one month and down the next. Patchy, the British call it. There also is no agreement among the British that new orders the coming year will hold up to recent totals. On the other hand, no one in Britain or on the Continent feels that the bottom is about to fall out of a very prosperous situation.

Asquith favors Common Market . . .

The British machine tool industry is highly in favor of Britain's joining the Common Market, according to Robert W Asquith, president of the European Committee and chairman of the Asquith Machine Tool Corp Ltd.

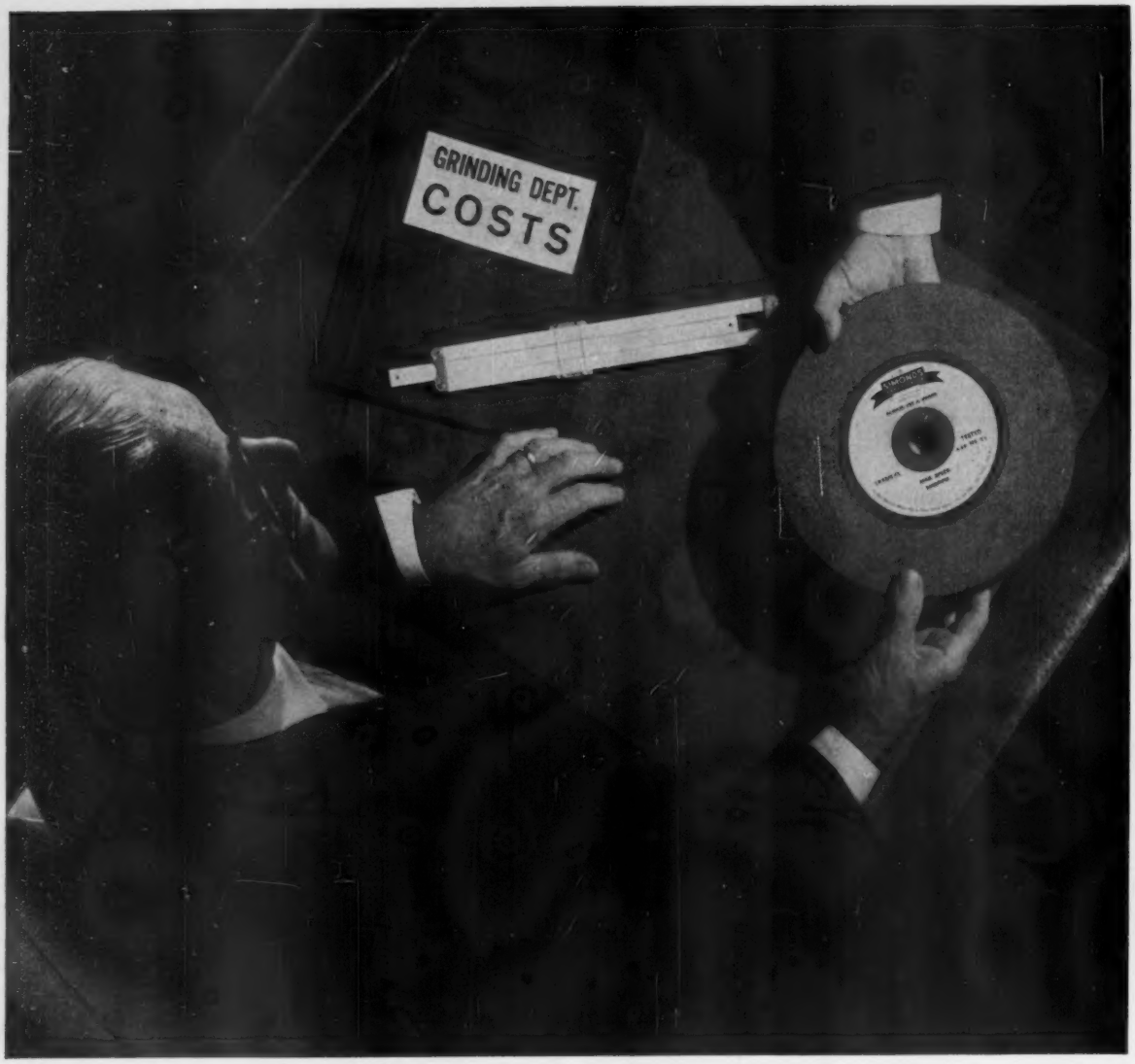
Such action would open up the prosperous Common Market territory to the British, but in turn the United Kingdom would be opened up to all Common Market members on an equal basis, free from tariffs.

Mr Asquith feels that on this basis the British industry has nothing to fear. "There is nothing to indicate that on grounds of price, delivery or technical quality, machine for machine, the UK industry is at a disadvantage compared with other machine tool manufacturing members," he states.

Though British builders have looked to the Commonwealth for a long time to take 50% of their overseas machine tool exports, the Commonwealth nations probably will be a decreasing source of business from here on, Mr Asquith predicts. Reasons for this change are artificial government controls designed to help home industry and increasing competition from the newer machine tool industries of the world.

"There can be no Commonwealth market along the lines of the Common Market," Mr Asquith feels. For one thing, there is no comparison between the purchasing power of the populations of the two areas, "an essential requirement for the formation of such a trading area."

Burnham Finney, AM/MM Editor, discusses Common Market with Robert W Asquith, president of European Committee and chairman of Asquith Machine Tool Corp Ltd, at European Show at Brussels



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MATERIALS...

New research in steel . . .

New horizons for steel, and the part research will play in reaching them, were described by Bethlehem Steel chairman Arthur B Homer at the dedication of the company's new $25 million Homer Research Laboratories October 9.

While new products "attract the most glamor," Homer said, these laboratories will place as much or more emphasis on the preparation of raw materials and on the steelmaking process itself.

Homer's predictions: processes for diffusing such materials as aluminum, titanium and chromium into the surface layers of sheet steel; methods to combine plastics and steel, and greater use of automatic controls in mills.

Plastic holds heating elements . . .

Electric heating elements are being molded integrally with reinforced plastic parts. According to the developer, Riverside Plastics Div. of Bischoff Chemical Corp, Hicksville, N Y, advantages include lower assembly costs, permanently aligned and protected elements, increased reliability, and reduced weight. There are no fasteners or adhesives to loosen under shock or vibration. The part is said to have high strength-to-weight ratio, impact resistance, and good electrical-insulating properties. Surface temperatures as high as 600 F can be attained without delamination. A wide variety of applications is expected.

CABRA opens Detroit office . . .

Leading makers of wrought copper-metal mill products are accelerating their technical liaison with the US automotive industry. A major step early this month was the opening of a Detroit office of the Copper and Brass Research Association under the direction of Richard D Chapman. It is significant that Chapman, 46, joined CABRA last month after a 25-year career with Chrysler Corporation. He left the position of Assistant Chief Engineer of Basic Sciences Research.

From temporary offices at 19730 Ralston St in Detroit, CABRA will move to permanent offices which will include a large technical library. Another major step in the accelerated effort of the copper industry to improve technical and other kinds of liaison with its customers, the automotive program is the latest of several moves.

In Connecticut, a copper-mill research center was recently dedicated and a new basic research laboratory was opened in Cambridge, Mass, by a copper-mining company. Through Detroit, the industry hopes to increase its share of the automotive-metal market. Currently this stands at about 200 million pounds annually of wrought copper and copper alloys as sheet, strip, rod, tube, and wire.

Copper research horizons . . .

Dr Charles H Moore, technical director of the still-new Copper Products Development Association paints an optimistic and imaginative picture. Copper producers believe it possible to achieve greatly improved properties in copper alloys, as the stainless steel people have done. They expect to find a way to protect the surface of copper, and copper alloys, to preserve the richness of color. This, of course, would open countless automotive, architectural, and industrial uses.

As an entry in the "materials derby" copper producers are thinking of copper as a composite—perhaps wedded to plastics. An expansion of printed-circuit techniques, the electrically insulated conductors would have many applications. An answer to the tarnish problem is sought by way of three different types of surface treatment.

Some of this research is in England. Two studies not motivated by this search may, nevertheless, throw some light on it: One study of the mechanics of surface reactions of copper is underway at the University of Arizona; another study of the effect of surface dislocations on copper's physical properties is at the University of Ghent, Belgium. The effect of oxygen on copper surfaces is of particular interest.

Copper in cast iron . . .

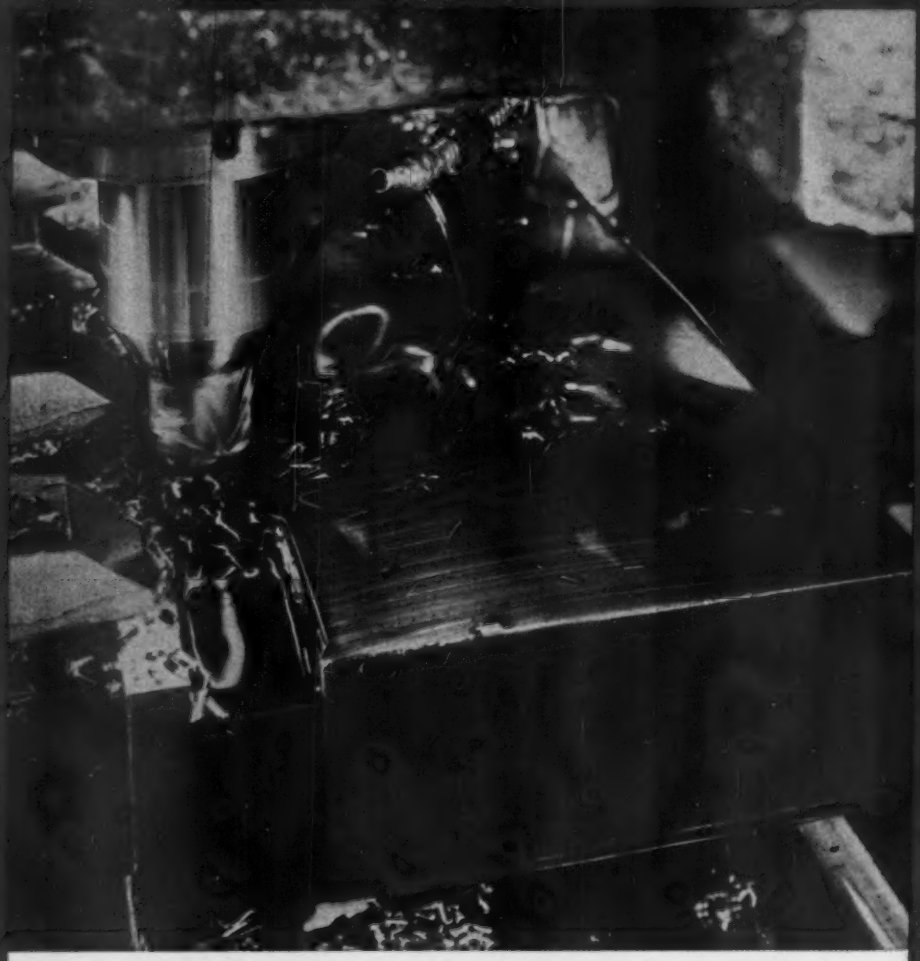
Research aimed at developing high-strength, thin-wall cast-iron engine blocks, weighing 30% less than standard blocks, points toward copper as an important alloying element in the cast iron.

Engineering application studies in the US, Canada, Great Britain, and Belgium are aimed at improving this copper-cast-iron alloy. The market-mindedness recently accelerated by the steel industry seems to have spread to copper.

Faster cutting screw stock . . .

Surface cutting speeds up to 600 sfpm are possible with a new screw-machine stock supplied by La Salle Steel Co, Chicago. Developed by Inland Steel Co, alloy is leaded B-1112 plus a small quantity of tellurium. (Details on p118.)

This mark tells you a product is made of modern, dependable Steel.



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WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production continues to advance . . .

The general pickup in metalworking activity that had been forecast for the fourth quarter seems to be on its way. No big surges have been reported, but most segments of the industry report increases and brightening outlooks.

Steel production continues to rise slowly, as the steelmakers had predicted. Stretchouts and holdbacks by the auto builders are holding down the rate of increase somewhat, but the production curve continues to rise.

Steelmakers expect production increases of about 8% or 9% in the fourth quarter over the third quarter.

Sheetmetal fabricators report slight pickups since the summer months, but business is still not good. Main gains are in consumer goods, with shops working a season ahead. Said one, "We just got the last of our snow plow and shovel business and we're starting on power tools and mowers for the spring."

Mill supply sales of cutting tools and gages are not very encouraging at the moment. Most dealers say that it will take a pretty strong fourth quarter for 1961 to equal 1960. The first quarter of 1962 is expected to be good.

The AGMA bookings index climbed to 252.5 (1947-1949=100) in the latest month. This is a volume increase of 14.9% in orders booked by the gearing industry over the previous month.

Heat-treating furnace builders report that business has picked up as had been expected. One major manufacturer says that business has been getting progressively worse." Others note that some of the inquiries are beginning to turn into orders, but that no big push is anticipated in the near future.

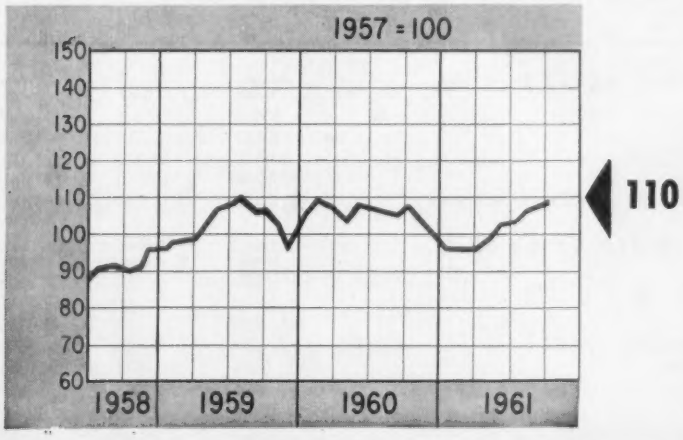
Aircraft-parts producers are optimistic, even though no effects of the accelerated defense program have filtered down to them yet. The outlook is for an improvement of 3% to 18% over 1960. And this is based on current volume; it does not take into account any sudden demands or ordering by the Defense Department. Sales of piston-engine parts continue to decline, and there's little chance of any change in this pattern.

Reports from welding shops are mixed. Some shops say that business is up as much as 20% over last year, and that repair work is adding healthy profits to their books. Other shops report spotty conditions. They're not overloaded, are working on average production schedules, with little in the way of overtime, but not so many short weeks, either.

Tool and die shops serving the automotive industry have slowed down at the moment, and the situation is uncertain because of auto contract renegotiations.

Because automotive retooling plans are behind schedule this year, and because much of the die work for '63 models as well as minor retooling must wait until major plans are set, there may not be much activity for a while.

Industrial fastener shipments rose 1% in the latest month, reaching an index level of 95 (1956-58=100), reports the Industrial Fasteners Institute.

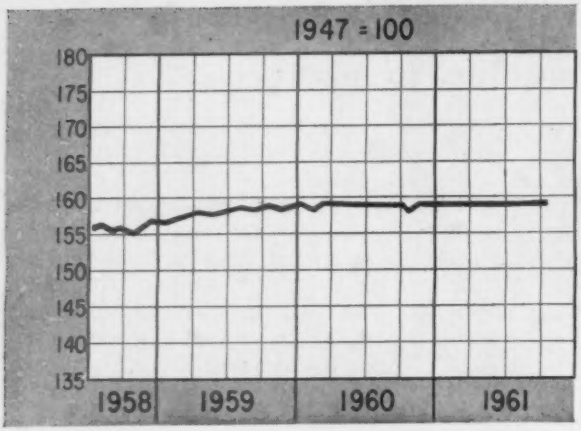


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEP Estimated	AUG Preliminary	JUL Revised	AUG Year Ago
Total Index	**110**	**109**	**107**	**106**
Machinery		105	103	103
Electrical Machinery		120	119	113
Autos		115	114	115
Other Transportation		90	91	89
Other Metalworking		113	111	111

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEP Estimated	AUG Preliminary	JUL Revised	AUG Year Ago
Total Index	**159.6**	**159.5**	**159.5**	**158.2**
Metalworking Machinery	**194.0**	**194.0**	**192.4**	
Other Machinery exec. Electrical	**174.2**	**174.3**	**172.8**	
Electrical Machinery	**156.7**	**157.8**	**159.4**	
Fabricated Metal Products	**147.2**	**147.0**	**147.6**	

Corporate profits head for new high . . .

Businessmen found their profits in the second quarter up substantially from the disappointing levels of late 1960 and the first quarter of this year. When the third quarter tabulations are completed, they should show profits run at a rate of $47.5 billions, and by the fourth quarter profits will have surged to a rate of $52.0 billions.

The year 1962 is now shaping up as the highest profits year in our history. This cheerful picture is beginning to emerge from recent corporate reports of profits and from a look at the factors that will influence them next year. Total profits, not including inventory valuation changes, should hit the $56.0 billion level next year.

There are two major factors pushing profits up so rapidly. First is the general rise of business which will continue right on into 1962. The third quarter rate of total national output topped $525 billion compared with the $501 billion GNP rate chalked up in the first quarter.

Another important factor in the profits picture is the increase in manufacturing productivity. Instead of rising steadily, year in and year out, productivity goes by leaps and bounds. It falls when rates of capacity utilization fall and rises when industry begins to use more of its capacity. Right now, production is on the upswing, and plants are coming into their most profitable operating ranges.

For 1961 as a whole, the gain in output per manhour may reach 7.5%, a mark scored or exceeded in 1950, 1955, and in 1959. All those years, as you will remember, were years of recovery after a recession. So if a 7.5% gain in productivity sounds a bit hard to swallow at first, remember that it has happened several times before. Obviously, a big gain in productivity could go a long way toward boosting profits well above their previous peaks.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	158.3	156.4	148.7
Steel ingot production (thousand tons)	2,131	2,114	1,558
Electric power output (million Kilowatt hours)	15,340	15,025	14,161
Production of automobiles	107,240	73,034	134,118
Engineering construction awards (*Eng. News-Record*, thousands)	$75,842	$71,247	$75,166

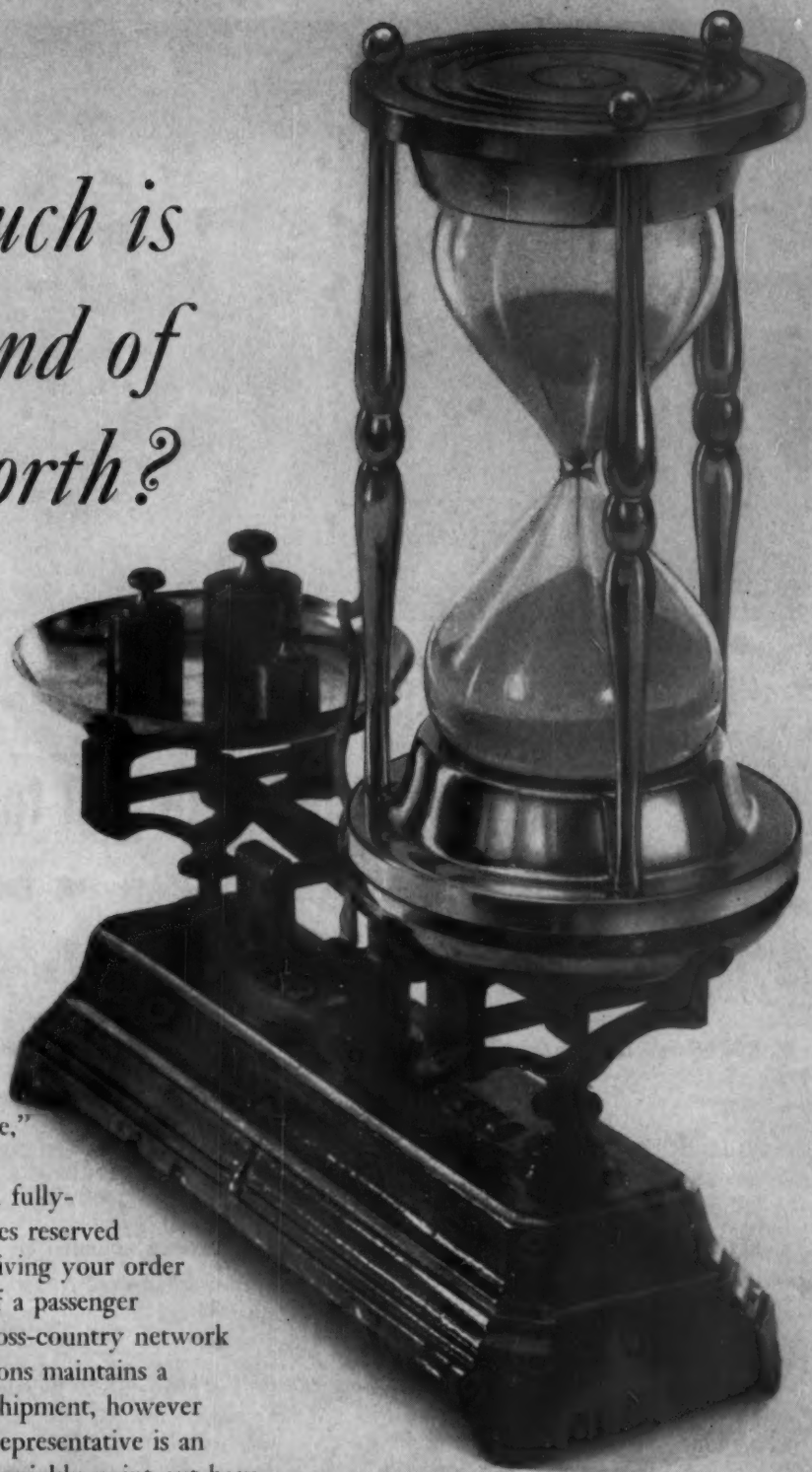
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	353	294	309
Vacuum cleaners sales (thousands of units)	242	241	246
Washers sales (thousands of units)	239	187	207
Household electric ranges sales (thousands of units)	70	69	68
Radio production (thousands of units)	1088	784	1551
Television production (thousands of units)	614	463	518
Gear sales index (1947-49=100)	220.0	198.0	269.8
Foundry equipment new orders index (shipments, 1947-49=100)	130.8	101.5	164.8

* Seasonally adjusted

CIRCLE 334 READER SERVICE CARD ▶

How much is a pound of time worth?



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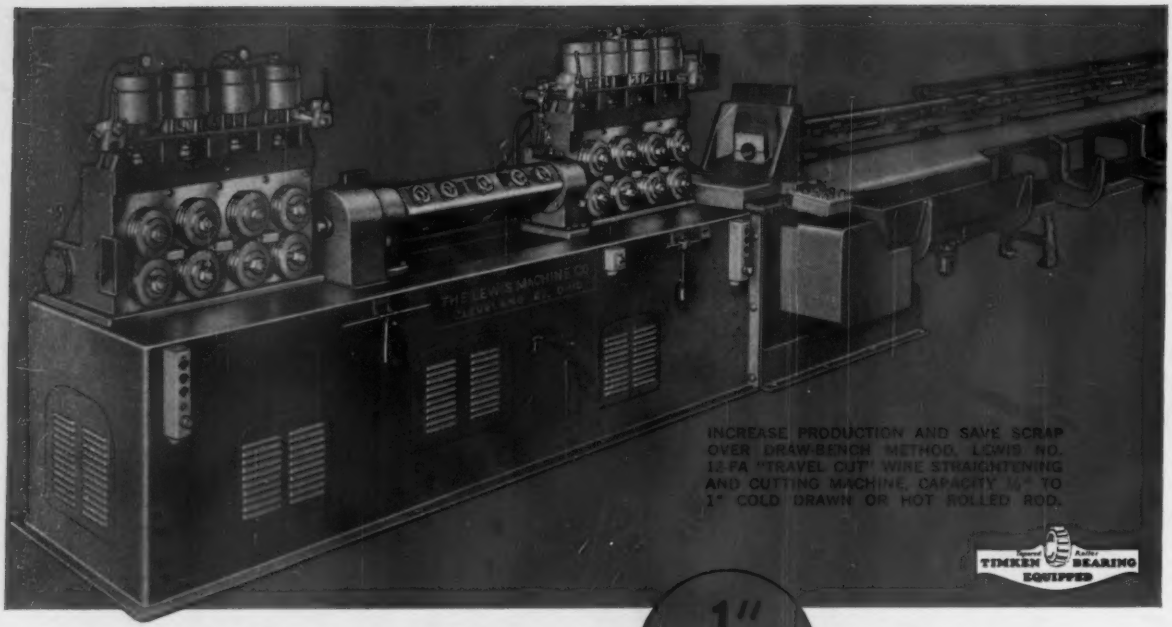
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LENGTH GAUGING Light pressure on electric trip switch actuates air clutch. Wire is gauged and released with positive moving mechanism . . . springs and latches have been eliminated.

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American Machinist / *Metalworking Manufacturing* ESTABLISHED 1877

Just for the Hell of It

Last year Soviet Russia built 183,500 machine tools, the largest number in its history. Chances are that production will be even bigger this year.

Communist China, which up to recently has had an agrarian economy, turned out an estimated 75,000 machine tools during 1960. All the Communist countries combined manufactured 371,000 machine tools last year.

Even more startling . . .

the Communist world, led by Moscow, has built in the past three years more than one million machine tools. That exceeds by a wide margin the number of machine tools produced in the United States from the end of World War II up to now—a period of sixteen years.

Western Europe, including Britain, has been doing better than the Communists. Its machine tool industry has been establishing new production records. In each of the past three years it has accounted for 40% of the world total, based on value in Swiss francs.

Our share of world production has shrunk alarmingly. Back in 1955-1957 we produced 40% of global output. But since then our ratio has declined sharply to 24%. And there are no signs of improvement ahead in our position.

While the machine tool industry in other parts of the world is robust and flourishing, ours is sick and anemic. This distressing situation augurs badly for us in case of war as well as in American industry's attempts to stay competitive with Common market countries and with Japan in world markets.

This is a time when . . .

under the circumstances, one would expect the federal government to regard the industry's position with deep concern. Yet what do we find? The only evidence of federal action is the current aggressive campaign of the Department of Labor to impose upon the machine tool industry a minimum wage under the Walsh-Healey Act covering government contracts of more than $10,000.

No industry could be farther removed from being a sweat-shop industry than machine tool builders. The machine tool industry constitutes a minute portion of the U S industrial economy. It would be interesting to know who picked it out for minimum-wage treatment and why.

Wage rates in the industry are not uniform. They never have been. Some builders are in large industrial centers, like Detroit, and obviously pay the prevailing rate in that area. Others are in the New England hills and in small communities where the cost of living and hourly rate schedules are less. Why should there be national uniformity, except perhaps to serve the purpose of unions?

Unions, in fact, are advocating that certain fringe benefits be included in a minimum wage. That is a new one which in previous determinations in other industries has not come up. What justification can there possibly be for foisting a compulsory fringe-benefit minimum on a depressed industry, or on any industry?

Last year the Labor Department . . .

as a preliminary to establishing a minimum wage, made a survey of current wage rates in the machine tool industry. It apparently was a miserable job, containing many errors. Its definition of "covered employees" was inaccurate and misleading so that final figures were mistakenly high.

No convincing reason has yet been advanced for application of a high minimum wage to the machine tool industry. Wage rates in the industry compare favorably with those in other industries. An artificial boost in the minimum by the government, just for the hell of it, will be disruptive and costly and can do nothing but harm to an industry that needs help rather than harassment.

But if the Labor Department cannot be turned from its inevitable course of imposing its will on the industry, the least it can do is to start all over again and make a fair and reasonable survey to serve as a base for its final judgment.

Burnham Finney **EDITOR**

Announcing the NEWEST LOOK IN **HOLES!**

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SHATTERPROOF

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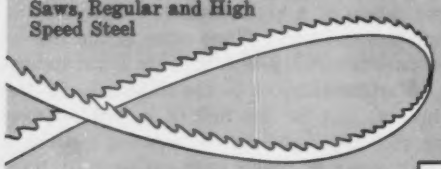
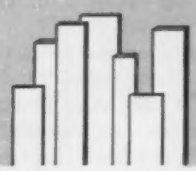
Nucut Hand and Power Hack Saws

Nucut Metal Cutting Band Saws, Regular and High Speed Steel





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SIX ARBORS FIT MOST CHUCKS! Straight hexagonal shanks, with pin-drive design in larger sizes, provide a non-slip grip when used in portable tools, drill presses, lathes, boring mills and milling machines. High Speed steel pilot drills have one flat surface for positive drive.

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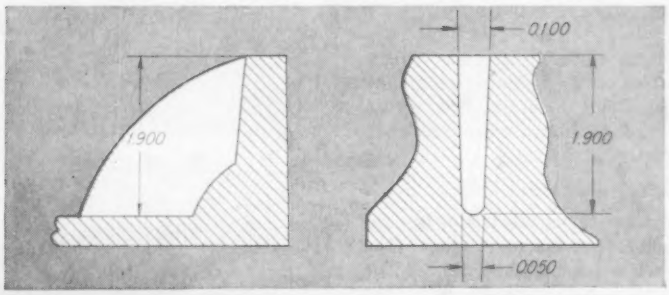
VOL 105, NO 21 **American Machinist** / *Metalworking Manufacturing* OCTOBER 16, 1961

EDM for the contract job shop

Here is how a battery of 10 electrical discharge machines handles a variety of tough job shop machining problems, ranging all the way from machining 5-foot diameter tire molds and large honeycomb panels to production of tiny precision grids for electronics

By Jon M Herman,
president
Allied Pacific Mfg Co
Compton, Calif



EDM produces complex shapes in hard forging dies such as these angular cavities (slots) sunk into a die body for forging impeller vanes. One of a set of shaped electrodes is replaced here with a new one for progressively cutting the relatively deep, thin cavities—in this case, 1.900-in. deep, or 0.100-in. wide at the top, and 0.050-in. at the bottom

Admittedly, electrical discharge machining is usually somewhat slower than conventional machining, but it *can* machine the "unmachinable."

For this reason, Allied Pacific, which does contract jobbing that varies widely in size, shape, and materials, and which may be called upon to machine lots ranging from a few pieces to several thousand, has set up special EDM department.

Here, a battery of 10 Elox machines produces extremely difficult shapes, and extremely thin sections with little or no stress concentrations. Allied Pacific reports other advantages of EDM over conventional machining, too.

Making forging dies

Typical of the difficult parts produced on this equipment are a number of dies for forging aluminum turbine impellers. One such is made of hot work die steel hardened to Rh 45 C. Impeller vanes are produced in the forging by means of 18 equally spaced radial slots in the die. These blade, or vane, openings are tapered and reach a maximum depth of 2½-in. at the extreme ends, where they are only 0.030 in. wide. Their curved, compound angular shape is produced in the EDM machine with brass electrodes of corresponding geometry.

Six or seven electrodes produce each slot, insuring a sharp, clean contour. (Erosion of a single electrode pushed through to full depth would tend to overcut or burn the metal and produce a poor finish, as well as lose accuracy).

Each electrode is fed into the die to the same predetermined depth before changing over to another. Depth of each cut is precisely controlled by micrometer stops that trip a limit-switch, stopping the machine when the required distance is traveled by the electrode. Changeover is simply a matter of releasing a set-screw, removing the used electrode, and replacing it with another. Full depth is first achieved with one set of electrodes in a roughing op-

eration that leaves a very small amount of stock for finishing. Then another set of electrodes—made to final dimensions—is used for finishing the job.

Roughing and finishing

A current setting of 20 to 25 amp is used for roughing and 10 to 12 amp for finishing. This produces a required surface finish of 62 microinches rms. Metal removal rates, of course, are controlled by the amount of current and finish requirements. Thus the greater the amount of current used for roughing, the finer the current setting for finishing.

Precise electrodes and low currents hold close dimensional tolerances. Not until one slot is completely finished is the die indexed for the next (about 3 hours are required to produce each slot).

Producing electrodes

The same set of electrodes is used for each slot in the same order. (No. 1 electrode for the first pass in the first slot is No. 1 for the first pass in the second slot and so on). But one brand new electrode is used for the final pass in each slot. Production of these electrodes with their relatively complex shape is no serious problem, because the firm employs its own Mimik hydraulic tracer unit on a milling machine to make as many as may be required for any of these impeller dies.

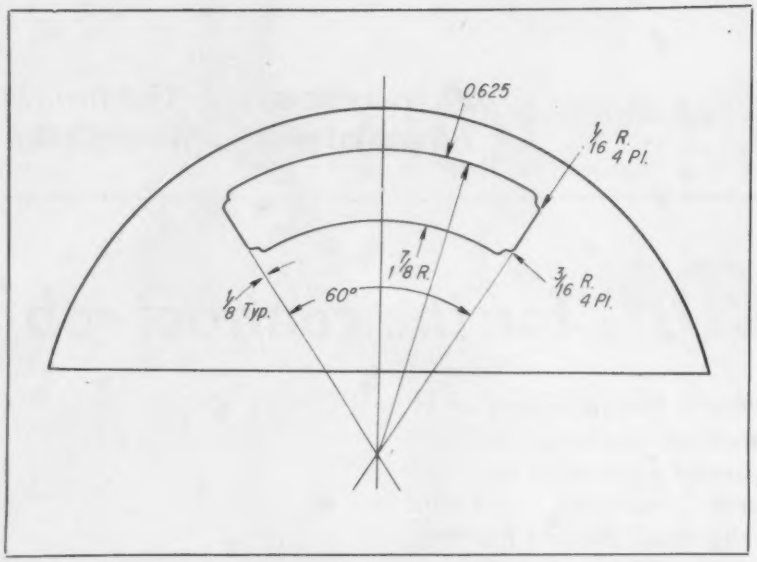
Setups on millers

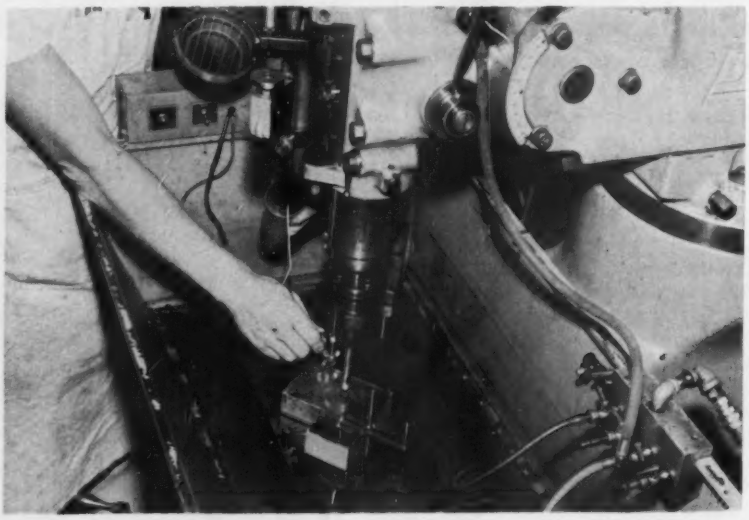
Three of the Elox setups are installed on Bridgeport milling machines to gain the advantage of revolving spindles, table movement, and angularly adjustable heads.

In one of these setups, a rotating brass tube was used as an electrode for producing 11/16 - in. - diameter holes. Three such holes were located on an arc in a flat piece of 0.063-in.-thick Haynes Stellite. This operation removed metal and provided an oil passage for subsequent routing out of a 60° arc in the plate with a shaped electrode in the same machine. Only 16 pieces were required in this run to produce outer gimbels for thrust bearing races.

In producing the holes, relatively high current—25 amp—was used for fast metal removal, contrasted with only 5 amp for finishing the arc with the shaped electrode. A spindle speed of 150 rpm was used with a feed rate of 0.5 ipm to produce each hole in 2 minutes.

Positioning of the Bridgeport table was so fast and accurate that no jig was necessary for precise hole location. About 10 minutes were required to complete this operation in each plate. Later, finishing the arc with the curved electrode only required 15 minutes.





Angular location of holes in a Haynes Stellite blank is achieved with this Elox head on a Bridgeport milling machine. Three such holes are produced on an arc to remove metal and later provide an oil passage for forming a curved opening in the plate with a shaped electrode

Machining honeycomb

One of the most unusual EDM setups in this plant consists of a special 4 x 8-foot table for contour machining large-area recesses in honeycomb core blankets. A special EDM head carries the electrode and is used manually as a hand router. Recess patterns are controlled by templets designed in accordance with the shape of raised webs and other elevated sections in stainless steel sheet which is later brazed to the blanket. With the recesses in the blanket in mating contact with the raised sections of the sheet, good brazing contact is assured in making honeycomb panels later.

To produce the recesses, the EDM operator is guided by the templet as he runs the hand router over the upper surface of the core blanket. The EDM router rolls on a "Skate" developed by North American Aviation, Inc (AM/MM Aug 8 '60, p69). The skate is mounted on flat ground

stock which rests on top of the blanket and controls depth of cut.

Electronic grids for TV

Depth tolerances are held within +0.002 in., –0.000 over areas as large as 100 sq in., using 10 amp current. Time required to machine a recess this large is about 180 minutes.

Among the numerous advantages of machining honeycomb core this way: it does not break the cells, it leaves no burrs, and no hold-down devices or special fixtures are needed.

Special electrodes produce screen-like electronic grids for TV transmission tubes from 0.250 to 1-in. diameter (with webs as thin as 0.003) to brazing of tiny wires—0.0015-in. diameter—to each other and to a ring to produce the screen-like pattern. EDM is not only a much faster technique but is also more accurate and more uniform in quality, and it eliminates the overlap of crossing wires.

Large-area recesses are cut into stainless steel honeycomb core with a special hand-operated Elox head. Relatively low current (about 10 amp) prevents overcutting or burning of the fragile cells. This results in clean, sharp-edged recesses that mate perfectly with raised webs in stainless skin that is later brazed to the core.

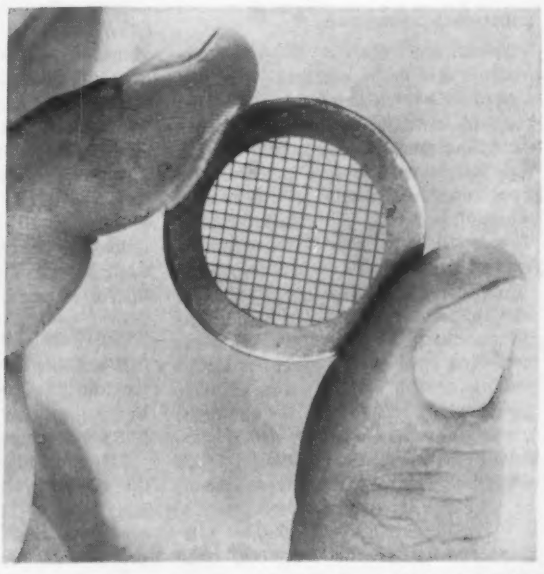
Controlling EDM current

EDM current here is very low (about 1 amp) so as to avoid too hot a spark, which would tend to make penetration of the blank too great and would cause burn-through of thin parts. Oil pressure is critical, too. Too much pressure would flatten the delicate webs and too little would prevent adequate flushing of the chips.

Cleanliness of the oil is important in all EDM work, to prevent minute particles from circulating between the electrode and the work, resulting in short circuits and consequent loss of accuracy. To meet the problem, an extensive oil filtering system has been installed to serve the EDM department. A buried 1000-gallon tank provides a complete source of oil for EDM operations. Used oil is filtered to an extremely high degree for reuse.

Electrodes are tailored to a variety of jobs . . .

Shaped electrodes for EDM work are made quickly and accurately with tracer-controlled equipment. This one has a knife-blade shape for sinking cavities in a forging die for producing buck knives

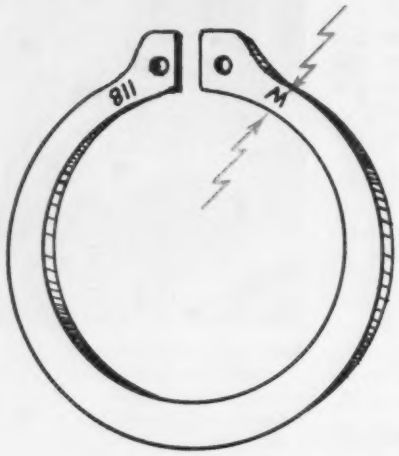


Tiny electronic grids are made with special brass electrodes, milled to produce an accurate screen-like grid pattern. EDM in this case eliminates costly and time consuming brazing of 0.0015-in.-diameter wires to a ring •

Metallurgical sleuthing shows that safe parts can fail when

Friction causes hard spots

By Allan Brooks
chief metallurgist
Truarc Retaining Rings Division
Waldes Kohinoor, Inc
Long Island City, NY



Etched marking was suspected when retaining ring failed at red arrows. Microhardness tests proved otherwise

The next time one of your parts fails during operation, don't necessarily blame the designer. Sometimes *any* design will fail, and the problem then is to find out what really caused the failure. Consider this example:

When we were evaluating a new retaining ring, one of two specimens failed, but the other did all right. Because the break was right across an engraved identification mark, we suspected a designed-in weak point. But we wanted to be sure.

To find out, we turned to microhardness testing. Our tests proved conclusively that the failure occurred during operation, not because of design.

As a matter of fact, the ring had been friction heated during operation, and the speed of this heating was enough to cause localized hard spots. (See *AM/MM*—Sep 4 '61, p97 for a discussion of this effect.)

These hard spots caused the ring to break.

Engraving suspected

The ring—which is 1.25-in. nominal dia and 0.050-in. thick—was designed to secure the inner race of a bearing in an automotive transmission. The ring sections which adjoin the insertion lugs are narrow, and they taper uniformly to the center, which has maximum section width. The small area near the lug is engraved with a size number.

While engraved rings had been used successfully in many other applications, only non-engraved rings had been employed during the initial testing of the transmission. Therefore, when the ring broke right across the engraving, we asked ourselves whether the engraving itself was detrimental as a stress raiser, or whether its location was poor .

We also considered such possibilities as whether the ring had been over-loaded, or whether the fault was in material, heat treatment, or other processing.

However, after our microhardness tests, we were convinced that the engraving was of no importance, and that the material and fabrication were perfectly satisfactory.

Different tests possible

In a case like this one, where a product has failed, a careful study of internal metal structure may absolve the metal quality and heat treatment. Or, it may reveal defects readily identifiable as a trouble source.

Very often, however, it is difficult to interpret structure solely from visual analysis. Under a metallographic microscope, polished and etched specimens may exhibit different structures which have the same etching characteristics.

When these structures are mixed, or present in very small amounts, identification by etching characteristics alone may be inconclusive. In such cases, microhardness testing may give the clearest information.

Examining the part

When we examined the surfaces, we found heavy indentations caused by the groove wall. Therefore, we looked at characteristics.

The ring had been heat treated to an ultimate tensile strength of approximately 245,000 psi, or a yield strength in shear of about 110,000 psi. It was designed to withstand a minimum thrust load of 7,000 lb (far greater than normally reached under dynamometer test conditions). Yet, for the ring to have deformed plastically and have groove indentations, its shear yield strength must have been exceeded.

The ring's hardness—Rh 50.5 C, which fell within the 47 to 52 range specified—and strength were correct. The actual thrust loads, therefore, must have exceeded those permitted by the design.

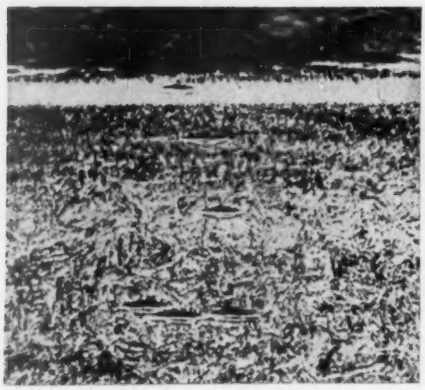
By comparing grooves on the two test specimens, we found that the fracture occurred precisely at that point where the load was applied against the exposed lugs and where the lugs joined the minimum section seated wholly within the groove.

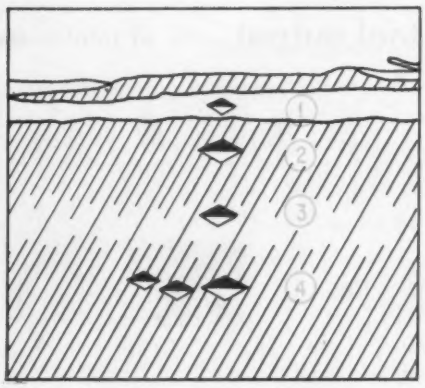
We also noticed that the ring surfaces were badly smeared. The fractured surface had a generally cup-cone and twisted shape—indicating adequate ductility—but the fractured surface itself was badly smeared. For this reason, evidence of fatigue could not be detected.

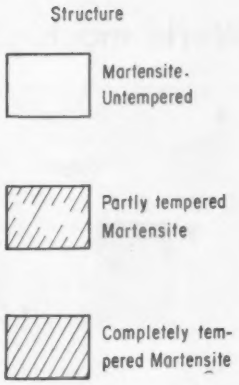
The metallographic structure was, generally, a fine-tempered martensite. There were no undue inclusions or other steel quality defects, and no network of cracks near the fracture.

The only unusual aspects of the metallographic structure were several small, irregular, light-etching patches on the surfaces of the ring —near the fracture and elsewhere. Although we couldn't see them at 100X magnification, a 600X look showed that some of them seemed to follow the outline of nicks in the smeared surface.

Some of the light-etching bands







Photomicrograph shows cross-section of fractured ring. Note bands of different etching characteristics (light-etching bands are martensite, darker bands are tempered) and the 5-gram Knoop indentations (short indentations in lighter bands indicate harder structure). In the schematic diagram, numbers identify different indentations. **1** is 49 Filar units long and 0.0005 in. below surface; **2** is 59 long and 0.0007-in. deep; **3** is 55 long, 0.0015-in. deep; **4** is 74 long at 0.0023 in.

were made up of different bands of varying width and shade, and the lighter structure appeared to be martensite, although this is a highly improbable structure to find in such an isolated shape and location. It would not result from improper quenching.

The structure did not appear to be decarburized, because this would have produced a light-etching zone made up of ferrite grains.

Continued investigation

Knoop readings were taken with a 500-gram load on a Tukon Microhardness Tester, since the standard Wilson hardness charts give a conversion to Rockwell C from this load for steel. These readings showed that the light-etching areas at the surface had hardness values of Rh 57 to 65 C, indicating presence of virtually untempered martensite.

The varying light and dark bands still had to be explored. Since these were too narrow for 500-gram indentations, we used a one-gram load for as detailed a survey as possible.

The readings from such a light load, however, had to be interpreted carefully. Optical aberrations around the ends of such small indentations affect the readings, and it is difficult to distinguish between such small marks and minor structural configurations. We also had to be more than careful to assure the extreme flatness and excellent surface polish normally necessary for tests.

Another drawback: Rockwell conversions are not significant for such low loads. Despite this, however, comparison of the lengths of the indentations were valuable, since they verified earlier assumptions based on etching characteristics and structure alone.

MICROHARDNESS READINGS COMPARED WITH ETCHING CHARACTERISTICS

ETCHING CHARACTERISTICS (FROM SURFACE INWARD)	METALLOGRAPHIC STRUCTURE	1-GRAM LOAD INDENTATION LENGTH (IN FILAR UNITS, 50X EYEPIECE)	ROCKWELL C, CONVERTED FROM 500-GRAM KNOOP READING
Light	Martensite	23½, 17, 26	(too close to edge for good readings with this load)
to Dark	Slightly tempered Martensite	26	60
to Light (light background with some dark-etching structure)	Mixed patches slightly tempered Martensite and Untempered Martensite	22 28 27½ 35 24	65 61
to Darker	Tempered Martensite	38	(band width too narrow for reading)
to Lighter	Some tempered Martensite	32, 36, 37, 39	57
to Dark	Completely tempered Martensite throughout core	42, 41½, 46	45½

This comparison is shown in the accompanying table, where the lengths are presented in eyepiece filar measuring units. For purposes of clarity, five-gram indentations were made in the photomicrograph.

The Knoop readings fluctuated in much the same manner as the etching shades: The darker bands gave longer indentations (softer metal) while the lighter bands (harder metal) gave shorter indentations. This showed conclusively that bands were composed of martensite tempered to a greater or lesser degree.

Proof of failure

Analysis of the above situation (martensitic bands) established the cause of failure. The fact was that the ring had been heated by friction as the retained part rotated and butted against the exposed lugs. This heating was highly localized, sporadic, and rapid.

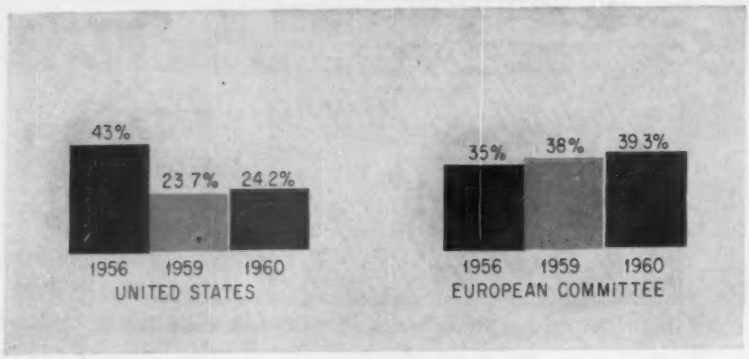
The speed of heating was actually enough to take the steel to its hardening temperature, at which point the mass of the surrounding metal pulled heat away rapidly. Thus the part was being quenched in a highly localized, over-heated spot.

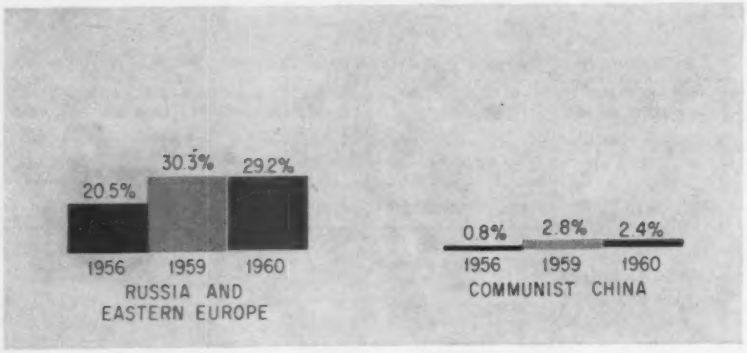
Successive heating in this manner tempered the hardened zone and caused newly hardened layers to form. These, in turn, were retempered to varying depths.

Subsequent inquiries revealed that lubrication, uneven surface of the abutting parts, and other problems causing friction may have existed in the unit where the ring failed. These sudden, highly localized structural variations—and the brittleness of such hardened zones—were severe stress-raisers.

These stress-raisers—rather than the size engraving—were the most likely starting points for destructive cracks. And, therefore, we could move our problem from the drawing board to the operational setup. •

World machine tool output (% of total value)





West Europe paces Free World gains in machine tool output

Western European countries, including Great Britain, produced almost 40% of the world's output of machine tools in 1960, according to a study made by the European Committee for the Cooperation of the Machine Tool Industries.

Eastern Europe, plus Communist China, turned out better than 31% of the total. The United States, which in the 1955-1957 period built around 40% of world production, was just under 25%. Last year was the third straight year in which these relative ratios have been maintained with only slight variations. The study converts the monetary value of each nation's shipments into Swiss francs as a common denominator.

Russia boosts output

Russia's manufacture of machine tools rose to 183,500 units last year from 160,000 in 1959 and 152,000 in 1958. Most of the increased output went into Russian plants. In sheer numbers, even Communist China has been out-producing the United States. It built an estimated 75,000 machine tools in 1960, about the same number as in 1959.

Communist bloc production

The Communist bloc (Russia, East Germany, Czechoslovakia, Poland, Hungary, and China) produced 371,000 machine tools in 1960. That compares with 34,000 in the United States (as reported by the National Machine Tool Builders' Association); the European Committee study gave no figure for 1960 U S output, but put shipments in 1958 and 1959 as about 65,000 units each year.

During the past three years (1958, 1959 and 1960) the Communist countries, including China, have built more than 1 million machine tools. That is more than the U S industry has turned out in all the years since the end of World War II, including the Korean War period.

West Germany paces Europe

West Germany continued in 1960 to be the principal European producer of machine tools. It built 43% of the total production of countries in the European Committee, as against 40% the previous year. The study noted increased output of machine tools in Japan (21%), in India and in Brazil.

Orders rise in E C countries

In the four "pilot" countries of the European Committee (W Germany, Belgium, France, U K), bookings for 1960 and early 1961 exceed 1957-59 levels by about 90%.

West European nations exported in 1960 42% of their machine tool production (it was 47% in West

Germany, 26% in Britain, 24% in France, 33% in Italy, Switzerland 71%). That is a gain over the 39.9% in 1958 and 38.1% in 1959. Germany, Britain, France and Italy provided the increase.

About 45% of the exports by European Committee countries went to other nations in the European Committee. Eastern Europe—Russia and her satellites—took 6.5%, the highest in recent years. Asia loomed large, with 16%, and Latin America with 9.5%. North America (U S and Canada) accounted for 7%.

U S machine tool exports

U S machine tool exports, the survey reveals, were distributed about like this in 1960: 44% to European Committee countries, 21.5% to Asia (mostly Japan), 17.3% to Latin America, and 12.5% to Canada. Exports from Russia and other eastern European nations to destinations outside the Communist boundaries were very small.

Imports into the United States, the study says, "remain at a low level." In 1960, as in the two previous years, they were around 6% of total deliveries to domestic users, with more than 40% coming from European Committee nations. [Dollar value of machine tool imports is based upon the value in the country of origin. To get at the true value of import figures, it is necessary to multiply the dollar value of imports by a factor of two and a fraction.—*Ed*]

Metal-forming machines gain

The study mentions the increasing importance of metal-forming machines. U S production of machine too'ls (in value) broke down in 1960 to 78% metal-cutting and 22% metal-forming. In France, based on weight, the ratio last year was 62% metal-cutting and 38% metal-forming.

West German figures on the relationship between cutting and forming types are the most detailed available anywhere. On the basis of value, they show that two-thirds of production last year were of metal-cutting machines and one-third of metal-forming.

German production of turret lathes, and automatic and hydraulic presses is rising, while production of planers, lathes, and drilling machines appears to be falling off.

Production of milling machines, gear cutters, grinders, plate-formers, and wire and bolt-making machines has been quite stable over the last few years in Germany. •

Machine tool orders

(Value in millions of Swiss francs*)

	1957	1958	1959	1960	1stQ '61
West Germany, Belgium, France, United Kingdom	3.275	3.206	3.981	6.728	1.617
United States**	2.821	1.658	2.837	2.830	0.744

* 1 Swiss franc = $0.2325

** European orders are not directly comparable to U S orders because of differences in types of machines covered.

Where U S and European Committee tools have been exported

	European Comm.		United States	
Destination	1956	1960	1956	1960
European Committee*	53.0%	45.5%	50.0%	44.1%
Other European countries	9.5	6.5	1.8	0.9
Eastern Europe	3.0	7.5	0.0	0.1
Africa	4.5	3.5	0.8	0.9
North America*	8.5	7.0	25.8	12.5
Latin America	7.0	9.5	12.1	17.3
Asia	10.0	16.0	5.8	21.5
Oceania	4.5	5.0	3.7	2.7

* European Committee nations' exports to other E C nations; United States' exports to Canada.

German production of machine tools (in value)

	1952	1953	1954	1955	1956	1957	1958	1959	1960
% metalcutting	75	74	73	70	72	72	69	67	67
planers	7.2	5.7	4.3	3.7	3.6	3.8	3.4	3.3	3.2
lathes	20.7	18.5	17.3	16.7	16.7	16.4	14.9	12.5	13.5
turret lathes	6.0	6.6	6.8	7.8	8.4	7.5	7.4	7.9	8.0
drilling, tapping machines	8.7	8.5	8.5	7.9	8.5	7.0	5.2	5.8	5.5
milling, boring machines	10.3	13.1	12.5	10.4	10.4	11.5	11.4	10.0	9.1
grinders	9.9	9.9	10.6	9.9	10.3	10.1	11.0	10.4	10.5
gear cutters	3.8	3.5	3.4	3.8	3.6	3.4	3.4	3.7	3.6
% metalforming	25	26	27	30	28	28	31	33	33
automatic presses	7.4	6.1	6.6	9.5	8.3	7.6	7.8	10.0	10.2
hydraulic presses	2.0	2.7	3.1	3.6	3.0	3.6	4.0	4.3	4.7
plate formers	4.3	5.1	5.0	5.3	4.8	5.3	5.8	5.5	5.0
wire-makers	4.8	5.1	4.9	5.0	4.6	4.5	5.6	5.5	5.4
bolt-makers	1.5	1.4	1.4	1.3	1.6	1.6	1.7	1.6	1.6

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Machine Tools

No big European push likely for

There is not likely to be any large-scale invasion of the U S machine tool market by European builders after the European boom has subsided, Burnham Finney, editor of AM/MM, predicted in his talk at the opening luncheon of the American Machine Tool Distributors Association's annual meeting, Pittsburgh, October 4-6.

Price differential narrows

Some European builders of standard machines will try to secure business here but it is doubtful whether the ratio of imports to domestic production will go up much. Costs in Europe are mounting faster than here and will continue to climb. There is a good chance that the price differential between American and foreign machines will narrow in the next five years.

Many European builders consider that the American market is the toughest in the world in which to do business, Finney said. They believe that 1) orders are expensive to get here, 2) the service problem is large and costly, 3) it is difficult if not impossible to get competent, intelligent, responsible, respected and well-financed distributors in this country who do not already have a full line of machines to sell, 4) many of the bigger U S buyers of machine tools are prejudiced against foreign-made machines, and 5) they can do better in other markets than the United States with the same expenditure of time, effort and money.

Western Europe and the Common Market in particular, according to Finney, is the fastest growing market in the world. It is a rich market in which to sell goods. It will be a powerful competitor in world markets and will provide American industry with its biggest competitive threat in the years immediately ahead, a threat much bigger than that from Soviet Russia.

The industrial revolution in western Europe, including Britain, will go on during the 1960s, though there are bound to be some ups and downs, Finney said. This revolution has been sparked by the automobile industry. If European car makers carry out present plans, they will have a capacity by 1965 for manufacturing more than 9 million units a year, a level attained only once (1955) by our own automobile industry.

Europe's labor shortage

There is a terrific shortage of labor throughout western Europe, Finney reported. The result is that wage rates are rising fast and industry is doing a lot of labor pirating by offering premiums to workers. The situation is aggravated by the free movement of labor between one country and another within the Common Market. The acute labor problem is almost sure to continue indefinitely.

This in itself will encourage mechanization and make profitable the use of high-production machines that were not attractive while labor rates were very low. The rapid increase in take-home pay of workers has had its advantages for the economy in that people for the first time have the purchasing power to buy all sorts of products that formerly they could not afford.

Glen W Bailey, vice president of International Telephone & Telegraph Corp, explained to the distributors how his company makes management decisions for capital investment and gave them some pointers on how to help themselves by helping their customers.

"Offer a complete line," he said, "not all Cadillacs. Have some compacts in the line, too, so that you can compete with used machines. In fact, I'll bet in most plants your biggest competition is used machinery, which in most simple cases is 90% as effective as a new machine but costs less than 40% as much. This is where a low-cost compact-type machine could nail down the order for you and better meet the customers requirements."

Other pointers he offered to the distributors amounted to a six-point program of helping the customer make an intelligent decision on capital investment.

- Be sure that the plant's estimate of the expenditure includes all cash requirements such as installation, accessories required to do the job, working capital, etc. An incomplete estimate may cause the plant management to be short of cash and will certainly throw doubt on the adequacy of the investment analysis.

SECRETARY-TREASURER
Robert W Nissen
President
E L Essley Machinery Co
Chicago

US market

• Assist in the preparation of estimates for changes in operating costs due to the proposed project. Help evaluate the impact on plant labor, material, and overhead accounts, and don't forget to include start-up costs.
• Adjust your approach to investment analysis to whatever procedures or forms the plant is using. Remember, all approaches for evaluating proposed capital investments relate changes in the income statement to changes in the balance sheet due to the investment.
• Get in early, so you can indicate, where justifiable, that it would be better to replace the old machine with the latest design you have available, thereby offsetting the natural tendency to replace the old machine with an up-dated model of the old design.
• Review the methods used for performing the jobs. At times, analyses are limited to replacement of individual machines, because of age and condition, when it would be far better if all machines involved were studied as a group.
• Don't oversell. A plant may need low-precision capability for most all the work it plans, if so, don't push precision equipment.

Elected to AMTDA's Executive Committee were Phil R Hoffman, vice president of Hoffman-Marquard Machinery Co, St Louis; Robert A Brechter, vice president and secretary, Vandyck Churchill Co, New York; and John L Addy, partner in Addy and Luby Machinery Co. •

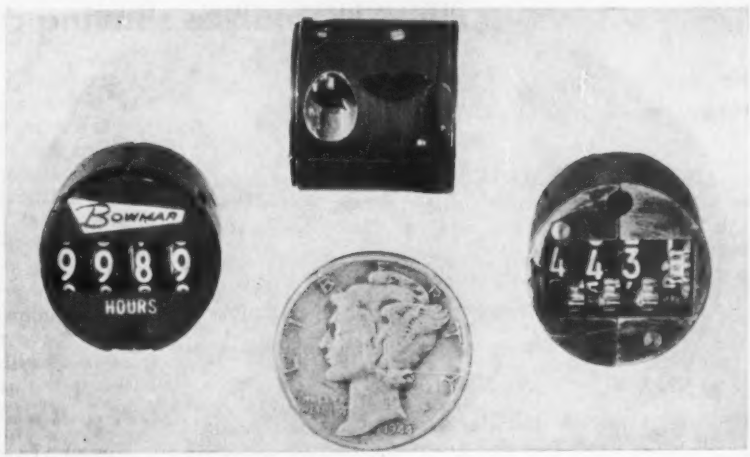
Tiny counter assembly wins '61 zinc die casting award

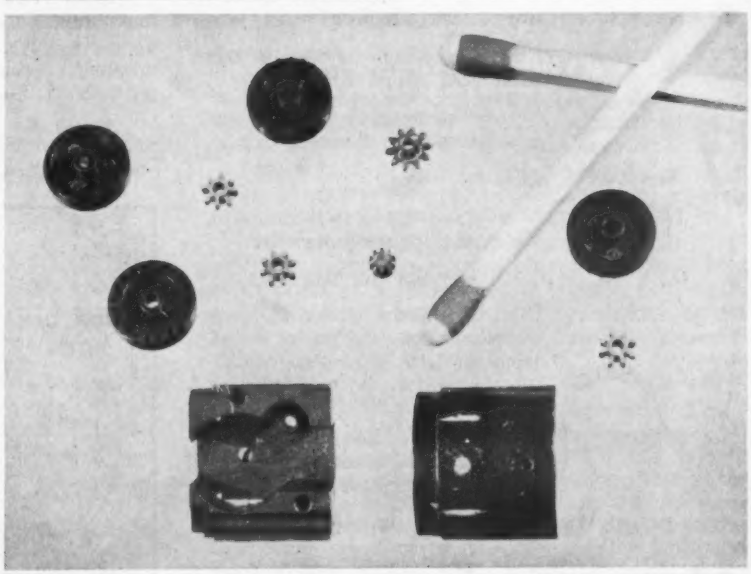
A subminiature counter assembly, smaller than a dime in circumference and weighing less than half an ounce, walked off with the "Zinc Die Casting of the Year" award in the second annual competition sponsored by New Jersey Zinc Co.

Die cast by Chicago's Hadlock & Temte Inc for Bowmar Instrument Corp, the assembly consists of a two-piece housing, four counter wheels and five gears (smallest is a ten-tooth bevel gear 0.063 in. high).

The housing was originally machined from aluminum bar stock and the counter wheels from brass, but by die casting these components Hadlock & Temte saved as much as 91.5% of total cost. All openings in the housing are die cast, and tooling costs ran to just $14,000.

Contest judges were William G Gude, editor of *Foundry* magazine, George C Nordenholt, former editor of *Product Engineering*, and Burnham Finney, editor of *American Machinist/Metalworking Manufacturing*.





(Top photo) Zinc die-cast assembled counters are shown at right and left. In center above the dime is the original machined counter assembly. (Bottom photo) Eleven castings make up the prize-winning assembly. Bevel gear (center) is only 0.063-in. high. Housing's crescent-shaped slots are cast in place to allow outer-most gears to clear housing wall as they turn. Diameters of mounting holes in housing at left are held to ±0.005 in. to insure snug fit, and correct shaft alignment

Will stock cutters shave new gears?

Rotary shaving cutters for finishing gear teeth are normally designed for a specific gear or range of gears. However, when a plant accumulates a variety of these cutters, the investment prompts study of their potential use on new gear designs.

There is a definite procedure for such analysis. Calculations made with the formulas given will show whether or not the proportions of the shaving cutter tooth are such that the gear will be shaved to the correct depth and size.

It is not possible to determine whether the shaving cutter analyzed will produce a satisfactory involute on the gear. After all, a shaving cutter performs best and provides the most accurate lead and involute forms when it shaves the gear or gears for which it was designed.

How to analyze shaving cutters

By Warren McNabb, gear engineer,
National Broach & Machine Co, Detroit

1. **Required Information**—The data listed below must be known for each gear and shaving cutter under consideration. Subscripts "*g*" and "*c*" denote gear and shaving cutter.

Symbol	*Description*
P_n	Generating normal diametral pitch
ϕ_n	Generating normal pressure angle
N_g & N_c	Number of teeth
ψ_g & ψ_c	Helix angle with direction (hand) at the generating normal diametral pitch
D_g & D_c	Generating pitch diameter in the transverse plane
ϕ_{tg} & ϕ_{tc}	Transverse pressure angle at the generating pitch diameter
D_{bg} & D_{bc}	Base diameter
T_{ng} & T_{nc}	Normal circular tooth thickness at the generating pitch diameter
D_{og} & D_{oc}	Outside or limiting diameters
SAP_g	Start of active profile on the gear measured along the line of action from the base diameter.
D_{dg}	Maximum root diameter of gear
SRP_g	Height of generated root fillet on gear measured along the line of action from the base diameter.

Because only existing shaving cutters will be considered, it will be necessary to obtain the number of cutter teeth (N_c), helix angle (ψ_c), normal circular tooth thickness (T_{nc}) and outside diameter (D_{oc}) from the cutter. The N_c and ψ_c values are usually stamped on rotary shaving cutters or they can be obtained from tool sheets supplied. The D_{oc} and T_{nc} dimensions should be taken directly from the shaving cutter by measurement. Circular-tooth thickness of cutter T_{nc} is best determined by a check over two pins.

It is also necessary to check the depth of the serrations on the profile of the shaving cutter. This can be a visual check to determine if the remaining tool life is sufficient for possible redevelopment and extensive use.

2. **Classify Gears to Be Shaved**—Arrange the gears in ascending or descending order of normal circular-tooth thickness at the generating pitch diameter.

3. **Determine Over and Undersize Gears**—After making the above classification, use formula (1) to determine the percentage of over-and undersize of the gears based on the basic-rack principle.

$$\text{Percentage Factor} = \frac{\Delta T_{ng} \times P_n}{2 \times t_{an}\,\phi_n} \quad \ldots (1)$$

Where: ΔT_{ng} is the difference between the actual normal circular-tooth thickness at the generating-pitch diameter and one-half the normal circular pitch less one-half the required normal backlash between mating parts. If T_{ng} is the greater, the gear is oversize.

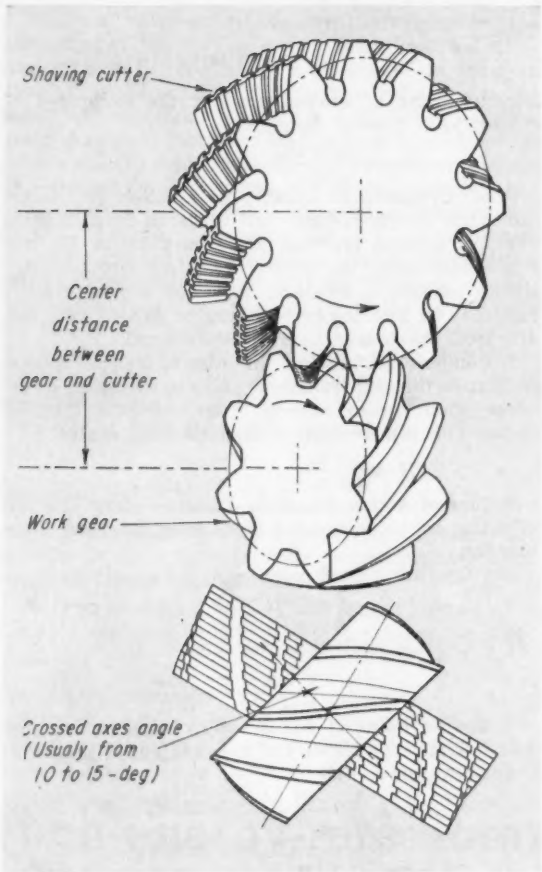
$$\pm \Delta T_{ng} = T_{ng} - \left[\frac{\pi}{2P_n} - \frac{\text{Nor. Backlash}}{2} \right] \quad \ldots (2)$$

The percentages obtained from formula (1) are

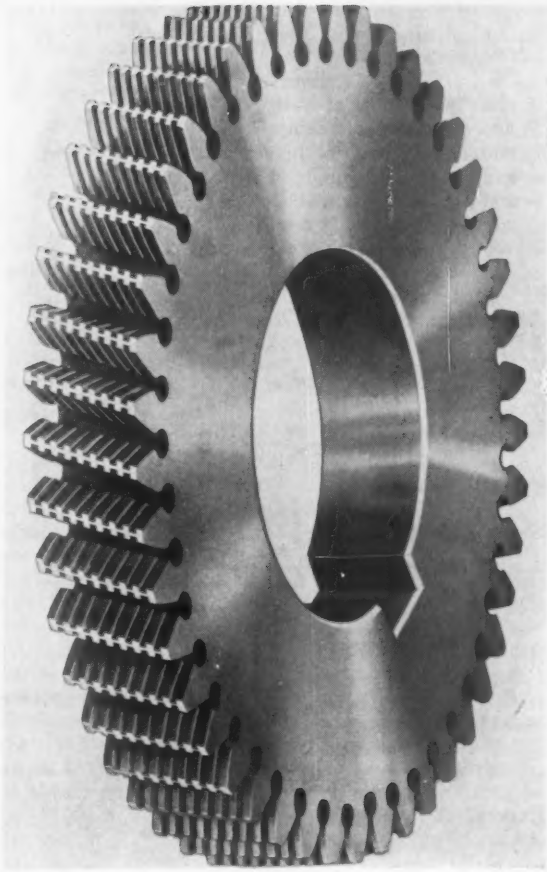
TABLE I

NOR. DIA. PITCH	GROUP NUMBER 1	2	3	4
	NUMBER OF TEETH IN GEARS			
3 and 4	15-17	17-25	24-37	35 and Up
5 to 7	14-17	17-26	23-40	35 and Up
8 to 10	14-18	17-29	27 and Up	
12 to 18	13-18	17-34	25 and Up	
20 to 30	13-22	20 and Up		
32 to 64	12-24	20 and Up		

Note: Numbers of teeth smaller than those shown will require special consideration



Shaving cutter is shown in contact with the work gear on a shaving machine



Typical rotary gear shaving cutter

reference values used for determining the magnitude of the over size or undersize conditions prevalent in the gears. These values can be charted, if desirable. However, the usual procedure is to first group the gears with ranges approximately as shown in Table I, and then in ascending order of the percentage factor computed from formula (1).

4. Select the Shaving Cutter:

(*a*) For the gears under consideration, P_{nc} and ϕ_{nc} must be identical to P_{ng} and ϕ_{ng}.

(*b*) Consider the crossed-axes angle. The approximate angle is obtained by taking the algebraic sum of the gear and cutter helix angles. For unlike hands the crossed-axes angle is equal to the difference of the helix angles; for like hands the angle is equal to the sum of the helix angles. On open gears with no crossed-axes restrictions, best results are obtained with crossed axes from 10° to 15°. However, the range can be extended from 3° to 18° in some cases, if knowledge of the results obtained from such practice is known. Gears with restricting shoulders must be treated separately, wherein the maximum crossed-axes angle allowable is obtained by layout or computation.

(*c*) If possible determine the T_{ng} and percentage factor (1) of the gear for which the cutter was originally designed. This knowledge is helpful when deciding upon the cutter design, which is most likely to be successful on the gears under consideration. This is true especially if the percentage factor is close and the number of teeth falls within the proposed group range. Usually gears of one group falling within a 50% bracket can be shaved with the same cutter (0 to + 50%, 0 to − 50%, etc). Best results are obtained by keeping over- and undersized gears on separate cutters.

(*d*) Depending upon the number of available shaving cutters, and the number of gears involved in a given group, it is usually best to match a cutter with a gear whose characteristics are close to the gear for which the cutter was designed. If the meshing computations have shown that the cutter will meet the physical requirements of the gear, the same cutter design is then meshed with the other gears in the group range.

5. Compute Tight Center Distance—After the shaving cutter and gear have been selected, it is necessary to compute the tight-mesh center distance between the two components. For this purpose formulas are given below. Because these equations were originally written for two gears, it becomes necessary to substitute the subscript "g" denoting the gear for the subscript "1" in the equations. Likewise the subscript "c" denoting the cutter must be substituted for the subscript "2". Therefore, $N_1 = N_g$ and $N_2 = N_c$ etc.

6. Formulas for Tight-Meshed Gears:

Purpose: To find the transverse operating-pressure

angles of a given pair of involute gears when operating in tight mesh with their axes crossed.

NOMENCLATURE:

Transverse Planes

N_1 and N_2—Number of teeth
D_1 and D_2—Given diameters
T_1 and T_2—Circular-tooth thickness at D_1 & D_2
ϕ_1 and ϕ_2—Pressure angle at D_1 & D_2
ψ_1 and ψ_2—Helix angle at D_1 & D_2
ψ_{b1} and ψ_{b2}—Base helix angle
ϕ_{r1} and ϕ_{r2}—Operating pressure angle
ϕ_{t1} and ϕ_{t2}—Transverse pressure angle at generating pitch diameter

Then follow these seven steps:

1...

$$E = N_1\left[\frac{T_1}{D_1} + \text{inv } \phi_1\right] + N_2\left[\frac{T_2}{D_2} + \text{inv}\,\phi_2\right] - \pi$$

2...

$$\text{Inv}\,\phi_{r1} = \frac{E}{N_1 + N_2\left[\frac{\text{inv } \phi_{t2}}{\text{inv } \phi_{t1}}\right]}$$

FIND sin ϕ_{r1}

3...

$$\text{Sin } \phi_{r2} = \sin \phi_{r1}\frac{\cos \psi_{b2}}{\cos \psi_{b1}}$$

FIND inv ϕ_{r2}

4...

First approximate check:

$$N_1 \text{ inv } \phi_{r1} + N_2 \text{ inv } \phi_{r2} \sim E$$

Note: Generally, the accuracy obtained with operating pressure angles ϕ_{r1} and ϕ_{r2} will be satisfactory if equation (4) differs from E by no more than 0.0010 in. However, if the difference is greater than 0.0010 in. or if greater accuracy is desired, it will be necessary to proceed as follows:

4A...

$$\text{Inv}\,\phi'_{r1} = \frac{E}{N_1 + N_2\left[\frac{\text{inv } \phi_{r2}}{\text{inv } \phi_{r1}}\right]}$$

FIND sin ϕ'_{r1}

4B...

$$\sin \phi'_{r2} = \sin \phi'_{r1}\frac{\cos \psi_{b1}}{\cos \psi_{b2}}$$

FIND inv ϕ'_{r2}

4C...

Check:

$$N_1 \text{ inv } \phi'_{r1} + N_2 \text{ inv } \phi'_{r2} \sim E$$

Note: Still greater accuracy may be obtained by repeating step 4A, using involute ϕ'_{r1} and ϕ'_{r2}. This is seldom necessary except perhaps when high crossed axes or high helix angles are being used.

5...

Then:

D_{b1} and D_{b2}—Transverse base circle diameters
D_{r1} and D_{r2}—Operating pitch diameters
ψ_{r1} and ψ_{r2}—Operating helix angles
T_{nr1} and T_{nr2}—Normal operating circular tooth thickness
p_{nr}—Normal operating circular pitch

5A...

The following formulas are used for both members:

$$D_r = \frac{D_b}{\cos \phi_r}$$

$$\tan \psi_r = \frac{D_r \tan \psi}{D}$$

FIND cos ψ_r

$$T_{nr} = D_r \cos \psi_r\left[\frac{T}{D} + \text{inv}\,\phi - \text{inv}\,\phi_r\right]$$

$$*p_{nr} = \frac{\pi D_r \cos \psi_r}{N}$$

*(Same on Both Members)

6...

Then:

$$T_{nr1} + T_{nr2} \sim p_{nr}$$

7...

Normal distance between axes at the centerline of crossed axes (center distance):

$$C = \frac{D_{r1} + D_{r2}}{2}$$

Note: Closeness to equality in equation (6) determines the accuracy of the center distance from equation (7). For general practice, the summation of T_{nr1} and T_{nr2} should equal the normal operating circular pitch within ±0.0005 in. However, most any degree of accuracy may be obtained by repetition of step 4A (see step 4C) until the desired accuracy is obtained.

7. Compute "H" Factor—In order to transfer dimensions from the gear transverse plane to the cutter transverse plane, or in reverse order, compute the "H" factor. This is a function of the base helix angles:

$$H = \frac{\cos \psi_{bg}}{\cos \psi_{bc}}$$

8. Line-of-Action Distance—Distance along the line of action in the transverse plane from the base diameter to:

(*a*) Operating pitch point = A_r

$$A_{rg} = D_{rg} \sin \phi_{rg}$$
$$A_{rc} = D_{rc} \sin \phi_{rc}$$

(*b*) Outside or limiting diameter = A_o

$$A_{og} = \sqrt{(D_{og})^2 - (D_{bg})^2}$$
$$A_{oc} = \sqrt{(D_{oc})^2 - (D_{bc})^2}$$

9. Lowest Point of Contact—Lowest points of contact in tranverse planes for gear and cutter are:

(*a*) On gear = FIN

$$\text{FIN} = \frac{A_{rg} - H\,(A_{oc} - A_{rc})}{2}$$

$$D_{FIN} = \sqrt{(D_{bg})^2 + (2\,\text{FIN})^2}$$

(*b*) On cutter = SAP_c

$$SAP_c = \tfrac{1}{2}\left[A_{rc} - \frac{(A_{og} - A_{rg})}{H}\right]$$

$$D_{cc} = \sqrt{(D_{bc})^2 + (2SAP_c)^2}$$

10. Length of Cutter Contact—Length of contact on the cutter, LC_c, equals the distance from the cutter tip down to SAP_c along the line of action:

$$LC_c = \frac{A_{oc}}{2} - SAP_c$$

Note: This value must be less than the available profile (AP_c) on the shaving cutter. The AP_c value is the line of action length of ground profile measured from the cutter tip down towards the base diameter. The value of AP_c can be determined from an involute checker or it can be computed. It is only necessary to check the difference between LC_c and AP_c in cases of very low operating pressure angles, extra long addendum on the gears or very large gears. The LC_c dimension is useful when modifications in the gear profile are being considered.

11. Extra Addendum "+A"—A computation is necessary to determine the amount of cutter addendum extending beyond the start of desired shaved profile (SAP_g). The term or symbol for this extra addendum is "+A". The cutter diameter for "+A" is known as "D_x'.

$$D_x = \sqrt{\left(\frac{A_{rg} - 2\,SAP_g + A_{rc}}{H}\right)^2 + (D_{bc})^2}$$

$$+A = \frac{D_{oc} - D_x}{2}$$

The "$+A$" value is most important in determining the usefulness of the shaving cutter being analyzed. It is analogous to the depth of profile shaved on the gear (point denoted as "FIN"). A positive value shows the cutter to be finishing beyond the SAP_g and a negative value denotes a "short addendum" on the cutter. On cutters already made the value can be shortened easily by reducing the cutter outside diameter. However, the value can be increased only by regrinding the cutter profile. Therefore, in this procedure, if the radial clearance (cl) between cutter and gear root (computed below) is less than desired or if the "FIN" point is too deep in the gear (perhaps contacting the gear fillet), the amount of "$+A$" can be reduced to a point of acceptance. In any event the "$+A$" value should always be positive. A rule of thumb for general use is approximately 0.100 in./P_n.

12. Radial Root Clearance—To find the radial root clearance:

$$cl = C - \left(\frac{D_{oe} + D_{dg}}{2}\right)$$

Note: The minimum amount of root clearance allowable depends entirely upon the conditions under which the cutter will operate.

13. Crossed-Axes Angle — The actual crossed axes angle, if desirable, is available by obtaining the algebraic sum of the operating helix angles ψ_{rg} and ψ_{re}.

Typical Calculation

A shaving cutter was designed for a 13-tooth pinion with standard tooth proportions. Problem: what is the tight-mesh condition when the cutter is used on a 14-tooth pinion, which is 20.3% oversize [as found by equations (1) and (2)]?

Data according to step 1:

$P_n = 8$
$\phi_n = 20°$
$N_g = 14 \quad N_e = 73$
$\psi_g = 25° \quad \psi_e = 10°$ R.H.
$D_g = 1.9309113 \quad D_e = 9.2657674$
$\phi_{tg} = 21.8802307° \quad \phi_{te} = 20.2835552°$
$D_{bg} = 1.7918179 \quad D_{be} = 8.6911833$
$T_{ng} = 0.2119 \quad T_{ne} = 0.1095403$
$D_{og} = 2.218 \quad D_{oe} = 9.207$
$SAP_g = 0.125$
$D_{dg} = 1.643$
$SPP_g = 0.046$

Calculations for steps 6 to 13 inclusive are performed, using the above data and the equations, but the details are not given here.

The calculated value of "FIN" (Sect. 9) = 0.1351593 and the negative value of "$+A$" = −0.0036157 prove the shaving cutter to be "short on addendum." Therefore this cutter with its present tooth proportions should not be used on the 14-tooth pinion. However, it is possible to redevelop this cutter for use on the 14-tooth pinion by reducing the tooth thickness until the addendum is a minimum of 0.0150 in. longer. •

High-energy-rate forming '61

"We know a hole in the ground isn't the right way but . . ."

"The kind of jobs are eventually get are the dogs that can't be done any other way."

Those two comments just about sum up the debit side of explosive forming, along with the lack of hardware and machinery for getting the process into in-plant shape.

On the credit side, however, as summed up at ASTME's HERF seminar in Detroit, September 27-28, are many reports on successful operations. For example:

• Bendix-Utica's Thomas S Riordan reported that his firm's Dynapak installation has turned out some 21,000 production parts in the last year—flanged shafts, diaphragm plates and gear blanks (mainly of steel alloys)—and is thinking about buying another.

So far, the Dynapak has been operated with closed dies producing a maximum flash of 0.050 in., minimum draft, and with single machine blows. Best lubricant to date: an aqueous suspension of graphite on the die (not on the work). Dual furnaces heat the work—one to 1600 F and the other to final heat (in a hurry) around 2000 F. The punch and die are preheated to 350 F, and full normalizing and tempering cycles are essential.

Riordan foresees such future potential for HERF as production of turbines and buckets, a bit of sheet-metal work, along with some cold working.

Explosive welding

• Explosive welding works with various metals in proportion to their ductility, John Pearson of the U S Naval Testing Station, China Lake, Calif, reported (see *AM/MM* Apr 17 '61, p119 and p110 of this issue).

A good weld job, he said, starts with the parts at an angle (1½ to 15°) and with mating surfaces chemically clean. The parts are covered with thin metal plates (to prevent explosion damage to their outside surfaces), then explosive is packed around the end where the parts join, and along outside surfaces.

At detonation, the welding point moves along the interface between the parts as they come together at 2500 to 7000 fps. The best welded junctions have a wavy effect—as mating surfaces exhibit jets of metal forced up by the action. These jets interlock the parts.

• Gas mixtures (hydrogen and oxygen, with an inert gas as the pressure medium) were described by Boeing's Richard Lingen, who said technique is similar to that with explosives, except that no water tank is required, the die must be closed, and the process does not require careful charge location. Best application: thin parts.

• Extrusion with the Dynapak, described by Westinghouse's F E Orrell, has been done with pure aluminum, silicon steel, Ti alloy, pure tantalum, and molybdenum. Tools for extrusion require tough alloy steels, with nickel alloy backup plates. Various grades of glass serve as extrusion lubricants. Major problem: flash between the die and the work container.

• Electric spark (electrohydraulic) forming shows potential as a fast operation that can handle odd shapes and develop very high pressures, according to Electro-Dynamics' Robert Felts. But, he said, it looks like Russia has the jump on us with a cold strip line already in production. •

what happens to

Explosively worked materials

By John Pearson
and George A Hayes
Michelson Laboratory
U S Naval Ordnance Test Station
China Lake, California

What happens to explosively formed metals? Much has been published on what kinds of parts can be formed by explosives, but little has been said about the mechanical properties of the formed materials.

To determine some of these properties we ran a series of tests on annealed 1015, 1030, 1050, and 4130 steels. One of the tests was designed to show the work-hardening effect of various size explosive charges.

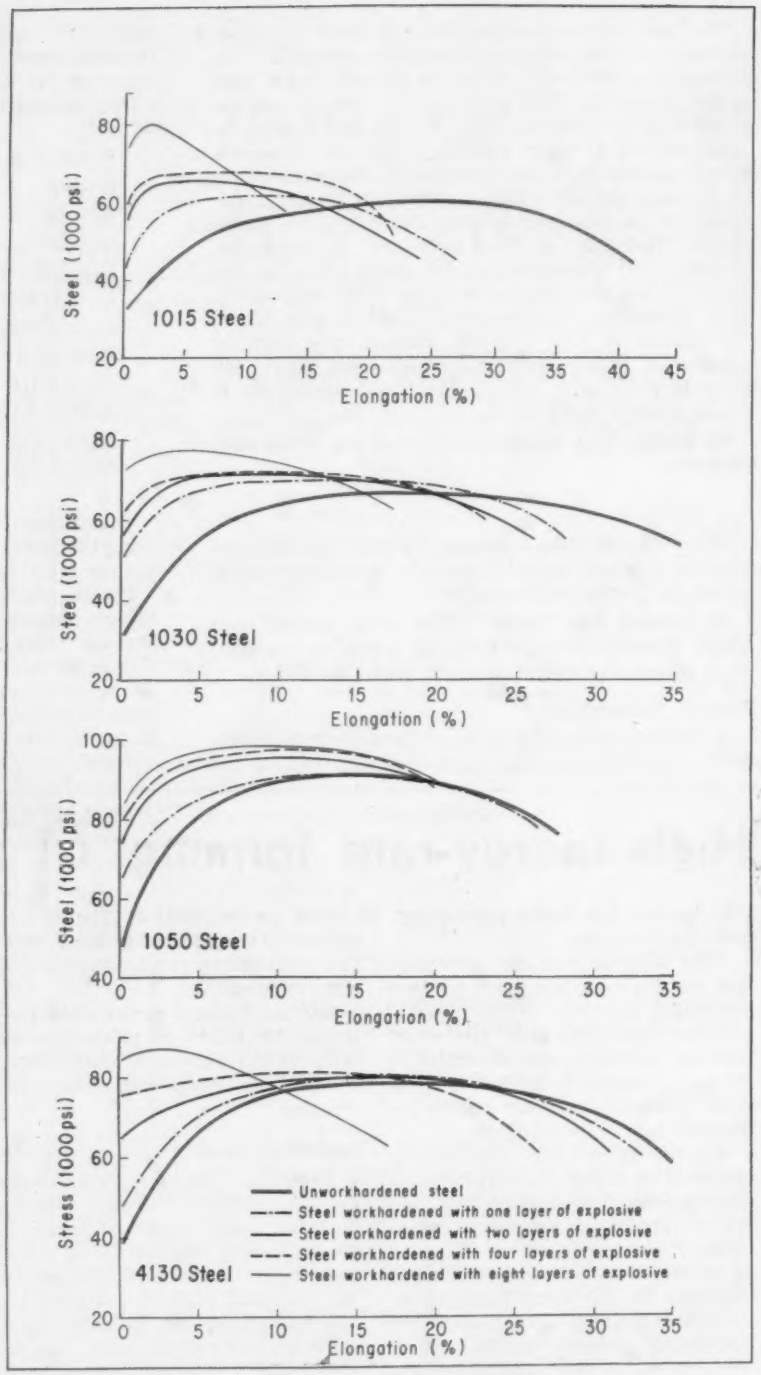
Four 10-in.-square, ½-in.-thick plates of each material were stacked and wrung together with a very thin film of oil. We then placed each stack on a large steel plate and put one or more sheets of 0.084-in.-thick DuPont plastic sheet explosive (PETN base) in direct contact with the upper plate in each stack.

Upon detonation of the charge, the large steel plate served as an energy sink, absorbing enough of the shock wave to prevent reflected stress waves from tearing apart the bottom plate in the stack.

Stronger, less ductile

To produce different loading conditions we ran tests using one, two, four, and eight sheets of explosive. Tensile specimens taken from the top plate provided the stress-strain data plotted at the right. In all cases the yield strength and ultimate tensile strength increased with increasing amounts of explosive, while ductility decreased.

Explosive work-hardening of the type described here can produce microstructural changes quite different from those produced by conventional working. Different degrees of work-hardening are usually present in the same part. And because of reflected stress waves, expansion of the metal upon load release, and other phenomena, localized regions of work-hardening are likely to develop within the material.



Workhardening effect of various size charges on steel plates

The same test setup was used to determine how the degree of work-hardening varied with distance from the charge. Tests on 1015 and 1030 steels showed that the top plate work-hardens the most; other plates in the stack are affected in proportion to their distance from the charge. •

American Machinist / *Metalworking Manufacturing*

Special Report No. 512 October 16, 1961

SHOULD YOU SWITCH TO LEADED STEELS? TRY THIS TEST . . .

Criterion	Circle Choice in Correct Column			
Machine-tool condition	new	good	fair	poor
Rated machine horsepower ÷ power actually drawn in cutting present grade of steel	over 2.0	1.5 to 2.0	1.1 to 1.5	under 1.1
Tool materials and tool geometry	———	best possible selection	could be improved	do not know
Total production time per part with present steel ÷ cutting time per part with present steel	1.1 to 1.5	1.6 to 2.0	2.1 to 3.0	over 3.0
Production cost per part with present steel ÷ tool cost per part with present steel	under 2.0	2.1 to 5.0	5.1 to 10.0	over 10.0
Material cost plus actual cutting-time cost per part with present steel ÷ material cost plus estimated cutting-time cost per part with leaded steel	over 1.5	1.2 to 1.5	1.0 to 1.2	below 1.0
FOR EACH ANSWER SCORE	3 points	2 points	1 point	– 1 point
Totals				
			Grand Total	

WHAT YOUR TOTAL SCORE SHOWS:
Less than 8 points: Leaded steels are not for you
9 to 12 points: Experiment to find out
Over 12 points: You will almost certainly profit by switching to leaded steels

The production man's guide to

LEADED STEELS

By Gerald X Diamond, metallurgical engineer

What are they? When should they be used?

What grades are available? What are their advantages?

How can they save you money?

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For several good reasons, leaded steels are becoming more and more popular. Cutting speeds can be much faster than with nonleaded steels. At the same time, tool life is longer, and there is usually a striking improvement in surface finish.

Although standard steels cost slightly less, the machinability of leaded steels is so much better that the user who switches to them can chalk up real production economies. Here are four examples:

- For a screw-machine part, one shop changed from B-1113 steel to leaded C-12L13. As a result, production time dropped from 40 to 30 seconds. Tool life doubled, from three to six hours, and finish improved to 60 micro-in., compared to the original 100. Nothing else but the speed was changed—from 220 to 290 fpm.
- A producer of drilling-equipment couplings used to bore them from solid 4640 barstock. By changing to 56L40, he was able to increase his cutting speed from 110 to 185 fpm. Overall production rose 30%, and the producer made a net saving of $500 on every thousand couplings he made.
- Another plant was machining standard steel castings with a hardness of 240 Bhn. A change to leaded-steel castings increased the hardness to 274 Bhn, but it also boosted effective cutting speed 25% and doubled tool life. Moreover, surface finish improved.
- A shop using 0-1 oil-hardening tool steel ran machinability tests on sample lots to which 0.15 to 0.30% lead had been added. It found that cutting speed for a 20-minute tool life improved from 115 fpm to 160 fpm—an increase of nearly 40%. The shop also found less distortion in hardening, because residual machining stresses in the leaded steel were lower.

There are many more examples that show what leaded steel can do (see table, p 113). And there are a few instances in which leaded steel gives no improvement at all. Just as there is a right time and a right place to use leaded steel, there can be a wrong place and a wrong time.

Let us examine the subject in detail, answering these broad questions: How do lead additives affect the mechanical properties of steel? the machining properties? What grades are available? Under what conditions can the user best take advantage of leaded steels? How can one estimate the cutting speeds, at various tool lives, that are possible with these steels?

HOW LEAD ADDITIONS AFFECT THE MECHANICAL PROPERTIES OF STEEL

Property	Effect of Lead Addition
Hardness	No effect. Hardness of leaded and nonleaded steels is identical.
Ultimate tensile strength	No effect. UTS of leaded and nonleaded steel is identical.
Yield strength	Yield of leaded steel may run 1 or 2% lower than nonleaded steel.
Elongation	About 1 or 2% lower than nonleaded steel.
Reduction in area	About 2 or 4% lower than nonleaded steel.
Fatigue strength	Up to 125,000 psi UTS, the unnotched fatigue strength of leaded and nonleaded steel is identical. As the UTS approaches 170,000 psi, fatigue strength of leaded steel drops off to 5% less than plain steel, and up to 16% less in isolated cases.
Impact strength	Impact strength and notch-sensitivity of leaded and nonleaded steels are identical.
Transition temperature	Transition temperature of leaded steel is a favorable 20 degrees lower than nonleaded steel.
Grain size	Lead addition refines the grain size.
Microstructure	Lead additions are virtually undetectable under the microscope unless surrounded with sulfide inclusions.
Coefficient of friction	Lead lowers coefficient of friction for steel on steel from 20 to over 50% that of nonleaded steel.

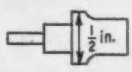
Effect on mechanical properties

Lead additions to steel are small, ranging from 0.15 to 0.43%. In such small quantities, lead has practically no effect on the physical or mechanical properties of steel. In free-machining steels like B-1113 and C-1141, no difference in mechanical properties has ever been detected. And extensive physical and mechanical tests run on leaded alloy steels show practically no difference in properties, compared to those of ordinary unleaded steels.

If the overall properties of leaded and nonleaded steel are the same, so are most of the individual properties. Hardness and tensile strength, for instance, are exactly the same. Ductility values for leaded steels are lower—but less than 2%, of little practical significance. Adding lead to steel does lower the fatigue strength slightly, when the ultimate tensile strength of the steel is greater than 125,000 psi. But up to this value, the fatigue strength of leaded carbon and alloy steels is identical to that of nonleaded steel.

As the ultimate strength climbs toward 170,000 psi, the fatigue strength of leaded steel continues to drop, falling to about 95% that of nonleaded steel (and to as low as 80%

Case histories comparing nonleaded & leaded steels

Example	Operation & depth of cut	Alloy & hardness	Speed, ft. per min.	Feed, in. per rev.	Production rate: parts per unit time	Tool life
A	Gear cutting (rough) 0.062 in.	4150	89	0.0237 Up 26%	Up 25%	Up 200%
		41 L50 255 BHN	111	0.0295		200% longer
B	Turning 3 in. dia. tube	4140	80 Up 34%	—	2.75 parts/hr. Up 45%	45 pcs. Up 45%
		41 L40	107		4.3 parts/hr.	65 pcs.
C_1	Turning socket wrench blanks—$1\frac{7}{16}$ in. round	4140	110 Up 50%	Constant	25 parts/hr. Up 40%	Up 200%
		Rycut 40	165		35 parts/hr.	200% longer
C_2	Same	4140	110 Up 73%	Constant	25 parts/hr. Up 56%	Constant
		Rycut 40	190		39 parts/hr.	
D	Taper turning 1 in. long x $\frac{3}{8}$ in. dia. part	303 S.S.	130 Up 65%	—	15 parts/hr. Up 50%	—
		303L S.S.	215		24 parts/hr.	
E		B-1113	190 Up 58%	Constant	90 parts/hr. Up 33%	3 hr. Up 100%
		Ledloy 300	300		120 parts/hr.	6 hr.
F	4 in. long x 1 in. dia. couplings drill thru and C/B	4640	110 Up 68%	.010 Up 30%	Up 30%	Constant
		46 L40	185	.013		
G	Center drill, ream, form, cut-off	B-1113	210 Up 40%	—	144 parts/hr. Up 36%	Up 400%
		Ledloy	294		156 parts/hr.	
Average benefits derived from leaded steel			Up 51.6%	Up 11%	Up 39.4%	Up 135%

in rare cases). These values apply to unnotched fatigue-test specimens only, because lead does not lower the fatigue strength of notched test specimens.

Charpy V-notch impact tests on leaded and nonleaded steels show that impact strength is identical. Because the transition temperature of leaded steel is about 20 F lower, it can serve at lower temperatures than nonleaded steel without becoming brittle.

Grain size is finer

In general, the grain size of leaded steel is a little finer than nonleaded steel of the same grade. And, during heat treatment, leaded steel is more resistant to overheating. In C-1050 leaded steel, for instance, grain size does not change up to temperatures of 1900 F.

Forming operations—forging, casting, cold-drawing—do not diminish the effect of lead. It is a much more desirable addition to alloy steels than sulfur, which embrittles the steel and lowers its fatigue strength drastically, even at low stress level. In one case where sulfur-bearing grade C-1141 steel was replaced by C-1040 leaded steel, fatigue strength climbed from 19,000 psi to 50,000 psi. Yet the machinability of these two steels was identical.

These comparisons make it clear that leaded steel can substitute for nonleaded steel in most applications. The only exception: high-stress fatigue parts, such as aircraft propellers and missile-pump parts. In particular, leaded steel makes long-lasting wear parts, and is ideal for such applications as machine components.

The table on p 112 summarizes the effects of lead on the mechanical properties of steel.

Effect on machining properties

Like sulfur, lead is an internal lubricant. It lowers friction by working over the cutting-tool face. Because of this lubricating action, the tool-workpiece interface (cutting edge) has a lower temperature than when cutting nonleaded steel. And the lower friction reduces the tendency of chips to weld to the cutting tool—important in the cutting of soft steels, where built-up edges possibly can form.

Because leaded steel can be machined at higher cutting speeds, the chips carry away more heat. Deep drilling and boring thus become more efficient, especially if the steel's lead content is on the high side. In sum, the lead in steel boosts production rates, because it permits faster cuts and heavier feeds.

Along with the rise in production comes another benefit: Chips from leaded steel are thinner and curl more tightly than those from ordinary steel. Thus chip removal in drilling and cutoff is simpler, and on turning jobs the curled, easy-breaking spirals drop neatly into the chip pan (much to the satisfaction of the operator who is familiar with flying chips).

SOME PRINCIPAL SUPPLIERS OF LEADED STEELS IN THE UNITED STATES

Alco Products, Inc, Latrobe, Pa
American Steel and Wire Div, United States Steel Corp, Cleveland, Ohio
Bethlehem Steel Co, Bethlehem, Pa.
Bliss & Laughlin, Inc, Harvey, Ill
Columbia Tool Steel Co, Chicago, Ill
Copperweld Steel Co, Warren, Ohio
Crucible Steel Co of America, Pittsburgh, Pa
Inland Steel Co, East Chicago, Ind
Jones & Laughlin Steel Corp, Pittsburgh, Pa
Joslyn Stainless Steels, Chicago, Ill
LaSalle Steel Co, Chicago, Ill
Moltrup Steel Products Co, Beaver Falls, Pa
Republic Steel Corp, Cleveland, Ohio
Joseph T Ryerson & Son, Inc, Chicago, Ill
Superior Drawn Steel Co, Monaca, Pa
Vanadium Alloys Steel Co, Latrobe, Pa
Western Automatic Screw Machine Co, Elyria, Ohio
Wyckoff Steel Co, Pittsburgh, Pa
Youngstown Steel Products Co, Youngstown, Ohio

LEADED STEELS AVAILABLE IN THE UNITED STATES

Carbon steels (Available on order)

Grades C-1015 through C-1095
B-1112 through B-1117
C-1118 through C-1160
C-1213 and C-1214

Alloy steels (Available on order)

Grades 1335
4017 through 4047
4118 through 4150
4320 through 4340
4615 through 4640
4720
4812 through 4830
5046
50B44 through 50B46
5117 through 5160 and 52100
6120 through 6150
8615 through 8650
8720 through 8750
9310
9440 through 9445

Special steels

A. Leaded plain carbon: (Regularly Stocked)
C-10L18
C-10L45
Ledloy 170 (MT-10L15)

B. Leaded alloy:	Carbon, %	Manganese, %	Chromium, %	Nickel, %	Other, %
Ryat 20 (C-86L20)	0.20	0.8	0.5	0.55	Mo, 0.20
Ryat 40 (C-41L40)	0.40	0.9	0.95	—	Mo, 0.20
Ryat 47 (C-41L47)	0.47	0.9	0.05	—	Mo, 0.20
Ryat 50 (C-41L50)	0.50	0.9	0.95	—	Mo, 0.20
Speedcut	0.40	0.85	1.15	—	Mo, 0.50
Smoothcut	0.50	0.85	0.25	—	V 0.25 Si 2.0 S 0.13
EZ Cut	0.24	1.25	—	—	—
Nitralloy G	0.4	0.6	1.60	—	Al 1.10 Mo 0.35

C. Leaded stainless steel
303 stainless

D. Leaded sulphur-bearing steels	Carbon, %	Manganese, %	Sulphur, %
Ledloy 375 Amerled B	0.15	1.00	0.40
Ledloy 300 RS Grade A Yolead A J & L Type A Amerled A	0.15	1.00	.0.25
RS C-12L13 Lo-Led	0.13	1.00	0.30
Rycase (leaded)	0.17	1.25	0.10
Rytense (Leaded)	0.41	1.55	0.13

All leaded steels contain nominally 0.15 to 0.30% lead, unless the user specifies another range of lead content.

Two other benefits

In two other respects lead additions improve the machining characteristics of steel:

(1) They shorten the shear path (that is, increase the shear angle), thus decrease the pressure needed to form a chip. For this reason, cutting leaded steel requires up to 25% less power. And the larger, heavier feeds possible do not overload the machine.

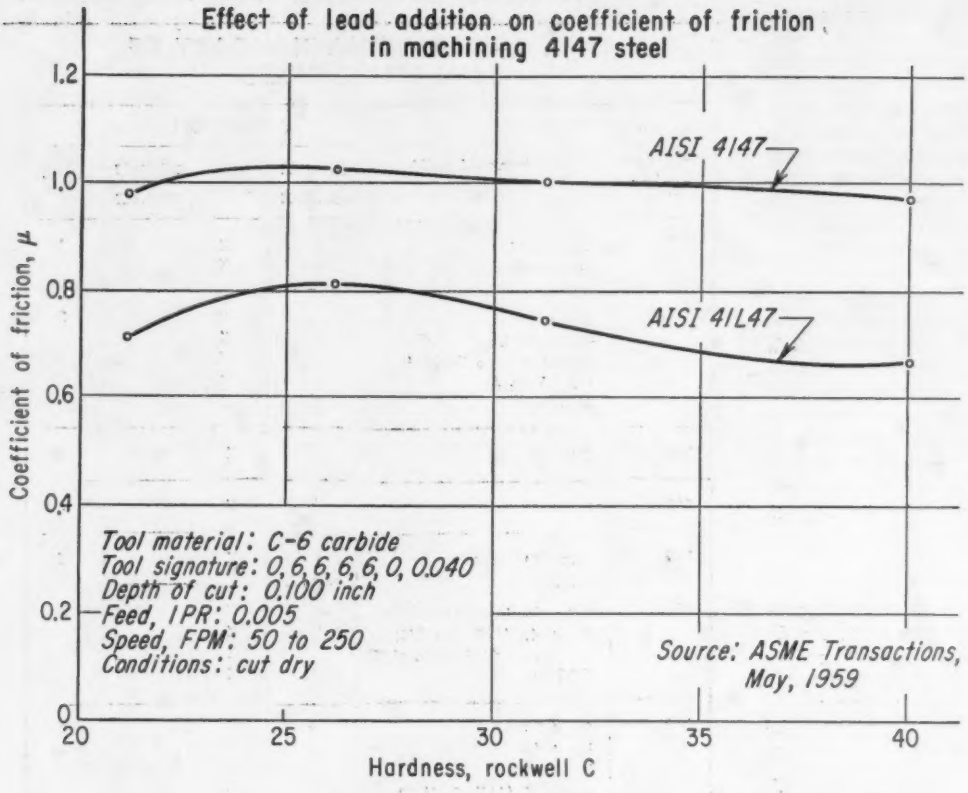
(2) Lead additions give the machined steel a better surface finish. In one case, changing from 4140 steel to 41L40 steel improved surface finish from 80/125 micro-in. to 40/60 micro-in. Here cutting was dry, with HSS tools.

All the foregoing advantages are subject to one limitation: The lead addition is effective only up to hardness levels of about Rh 30-35C. When hardness increases to beyond Rh 40C, lead has less and less effect in improving machinability. Finally, at Rh 45C, the effect of lead additions is quite small. But some users of leaded steel with a hardness of Rh 50C have reported at least a few distinct advantages over nonleaded steel.

Grades of leaded steel available

Practically any grade of steel (including sulfurized free-machining steels) gains in machinability when lead is added. In plain carbon steels, for example, lead additions make these steels as machinable as the equivalent sulfurized grade—without lowering mechanical properties, as sulfur does. In alloy steels, lead additions greatly increase machinability, especially in the hot-rolled and cold-drawn conditions. And leaded Nitralloy and tool steels are much easier to cut.

To meet the demand for steel with unusually good machining properties, many companies have put special grades of leaded steel on the market. These special grades usually



come in a wide variety of sizes, but most of the leaded standard alloys must be ordered to size. The table on p 114 shows a number of leaded-steel grades stocked for off-the-shelf delivery, as well as the major suppliers in the United States.

The leaded sulfur-bearing steels given in this table deserve special comment. Both lead and sulfur increase the steels' machinability, that is, their effect is cumulative (though not strictly additive). More specifically, lead increases the allowable cutting speed for low-carbon, sulfur-bearing steels at least 25% when present in amounts over 0.15%. Cutting speed of annealed low-carbon steels with normal sulfur content can be raised 20 to 30% when lead is added. Doubling the amount of lead in a steel (say, from 0.15 to 0.30%) is roughly equivalent to doubling the same percentage of sulfur.

SPOT CHECK FOR PRESENCE OF LEAD IN STEEL*

1. File a rough spot on the metal.
2. Apply a few drops of 5% caustic soda solution.
3. Pick up on blotting paper after 1 minute.
4. Apply a few drops 5% sodium sulphide solution to the paper.
5. Brown stain positively indicates lead. No color—no lead.

*Courtesy Ryerson Steel Co.

To use or not to use?

Not every shop needs—or should want—to machine leaded steels. In fact, the decision to switch to leaded steels should come only after the shop makes a careful analysis of what it is now doing and what it wants to do. Let us examine the basic requirements for getting the most out of leaded steels.

First of all, the machine tool that will do the work must be in top-notch condition. If it isn't, the shop may be able to get faster speeds simply by overhauling the machine. Here there is no point in switching to leaded steels, if the shop can boost production to a satisfactory level by machining standard steels at faster speeds.

If the machine is in A-1 shape, and if it has a capacity much greater than the top speeds at which non-leaded steels can be machined, a switch to leaded steels may be advisable. On the other hand, if the machine's entire capacity is being used on a non-leaded steel, and tool life is satisfactory, then leaded steel offers no advantage.

With the right machine, leaded steel pays off under the following conditions: when the shop needs better tool life to make a job more profitable, or when faster cutting speeds or heavier feeds are sought to boost production rates. In any case, the additional cost of leaded steel must be recovered by tangible savings in time or tool costs. (Costs aside, if the need is for better surface finish, then leaded steel again may solve the problem.)

For best economy, the ratio of

cutting time to the total production cycle must be high: 75% or more. Or the cost of machine time should be very high relative to material costs per part. Such conditions, usually accompanied by high volumes of metal removal, are characteristic of screw-machine and turret-lathe work in particular. They frequently occur in milling and drilling, and occasionally in such work as broaching and sawing.

Tool geometry is important here. If changing it will improve the production rate with nonleaded steel, this may be less expensive in the long run than a change in steel grades. Even a change in tool material—to carbide or ceramic—may outweigh the savings possible with leaded steel. Incidentally, a switch to leaded steel will not cure tool abuse.

Consider cutting oils

Another important factor is cutting oils. For operations that should be run dry, leaded steel offers an inexpensive way to boost speed without having to go to a cutting oil. In fact, cutting oil actually retards the lubricating effect of lead, because the oil prevents the smearing of lead over the tool face. Where extremely high cutting speeds generate excessive heat, and tool life is short, then water-base coolants are effective with leaded steels.

The table reproduced on the first page of this article gives a short-cut way to help the designer or estimator select or reject leaded steel for a part. Carbon and sulfurized steels with lead additions cost 90¢ to $1 more a hundred pounds (about 7 to 10% more) than the standard grades. Alloy steels with lead cost about $1.50 more (10 to 15%) a hundred pounds.

Actual machining results

As examples of what others have achieved, the table on p 113 presents case histories taken at random from the records of steel suppliers, tool engineers, and tool manufacturers. On the whole, these examples show that leaded steel permits an increase in cutting speed of from 25 to 73%. At the same time, tool life increases, and there is some improvement in surface finish.

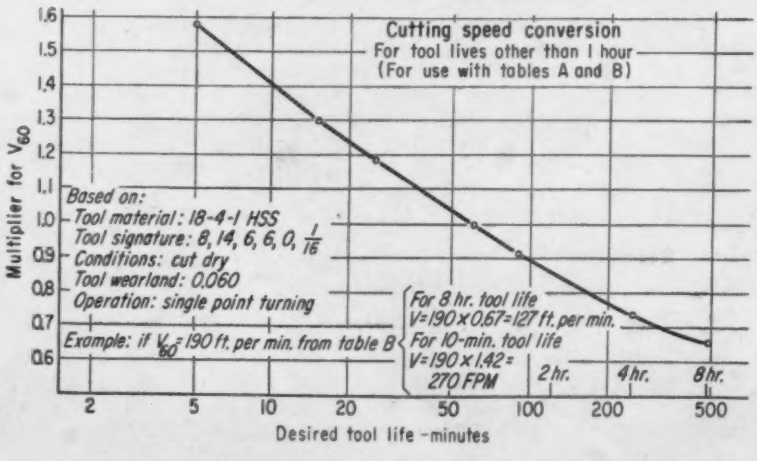
Because true production economy —especially on engine-lathe work and simple turret-lathe jobs—is achieved at relatively short tool life (10 to 20 minutes), a speed increase of nearly 100% with no change in tool life is not unreasonable for a

HOW TO ESTIMATE CUTTING SPEEDS

TABLE A—RELATIVE MACHINABILITY OF SOME LEADED STEELS

APPROXIMATE CUTTING SPEED, 8-HR TOOL LIFE (SFM)	RECOMMENDED ALLOY	CONDITION			REFERENCE GROUP*
		ANNEALED OR AS-ROLLED	COLD DRAWN	QUENCHED & TEMPERED	
375	Ledloy 375		X		1
	Amer-led B		X		
300	Ledloy 300		X		2
	RS Grade A		X		
	Yolead A (type C-12L14)		X		
	J & L Type A		X		
	Amerled A		X		
260	C-12L13		X		3
225	C-1213**		X		4
165	B-1112**		X		5
150	Rycut 20 (AISI C-86L20)		X		6
	Rycut 40 (AISI C-41L40)		X		
	New Rycut 50 (AISI C-41L50)		X		
	C-10L18		X		
135	Rycut 20	X			7
	Rycut 40	X			
	Rycut 50	X			
	Rycut 47 (AISI C-41L47)		X		
	C-10L18	X			
	C-10L45		X		
120	Rycut 47	X			8
	Rycut 40			X	
	AISI 4140**		X		
105	New Rycut 50			X	9
	Rycut 47			X	
	C-10L45	X			
	AISI 4140 215 BHN**	X			
	303 Stainless Leaded		X		
100	C-10L45			X	10
	AISI 4140**			X	

*For use with Table B **For Reference Only—No lead


Cutting speed conversion
For tool lives other than 1 hour
(For use with tables A and B)
Multiplier for V60
Based on:
Tool material: 18-4-1 HSS
Tool signature: 8, 14, 6, 6, 0, 1/16
Conditions: cut dry
Tool wearland: 0.060
Operation: single point turning
Example: if V60 = 190 ft. per min. from table B
For 8 hr. tool life
V=190 x 0.67=127 ft. per min.
For 10-min. tool life
V=190 x 1.42=
270 FPM
2 hr.
4 hr.
8 hr.
Desired tool life - minutes

AVAILABLE WITH LEADED STEELS

TABLE B—APPROXIMATE CUTTING SPEED FOR ONE HOUR TOOL LIFE

Alloy Group	Depth of cut in.	FEED, ipr 0.004	0.007	0.010	0.015	0.020	0.025	0.030	0.040
		CUTTING SPEEDS FOR ONE HOUR TOOL LIFE (V60)—FPM							
1	Below 0.010	1,150	855	715	580	515	—	—	—
	.050	920	670	540	440	380	340	305	265
	.100	790	560	450	360	310	280	250	215
	.250	685	480	400	310	255	230	205	175
2	Below 0.010	980	720	595	470	415	—	—	—
	.050	740	550	465	375	320	295	265	230
	.100	680	510	415	325	285	260	230	200
	.250	600	430	360	290	245	210	190	160
3	Below 0.010	890	630	500	410	350	—	—	—
	.050	720	515	420	340	290	260	230	200
	.100	675	490	400	315	270	240	215	190
	.250	570	410	315	255	215	180	165	140
4	Below 0.010	800	560	465	370	310	—	—	—
	.050	650	465	380	290	250	220	205	180
	.100	615	415	345	270	235	200	180	155
	.250	535	350	300	235	200	170	155	135
5	Below 0.010	650	520	425	310	265	—	—	—
	.050	530	405	315	235	200	180	165	155
	.100	450	340	265	200	170	150	140	130
	.250	390	290	235	170	140	125	115	105
6	Below 0.010	630	450	350	260	210	—	—	—
	.050	525	362	295	215	180	155	130	110
	.100	390	300	230	185	150	130	115	100
	.250	335	225	175	140	115	100	87	72
7	Below 0.010	600	420	315	240	190	—	—	—
	.050	510	330	260	190	160	135	120	90
	.100	355	260	200	155	120	110	95	78
	.250	275	195	155	120	100	85	74	61
8	Below 0.010	550	365	280	210	175	—	—	—
	.050	390	275	215	165	135	115	99	80
	.100	290	220	165	130	110	95	83	68
	.250	165	125	110	85	73	65	58	50
9	Below 0.010	395	280	230	180	155	—	—	—
	.050	230	170	135	105	88	77	68	59
	.100	195	140	115	92	78	70	61	52
	.250	140	102	83	66	56	50	45	39
10	Below 0.010	305	230	190	160	135	—	—	—
	.050	185	140	120	95	82	73	67	57
	.100	150	115	94	78	69	53	56	49
	.250	115	85	70	57	48	43	39	33

To estimate cutting speed for leaded steel, (1) pick out from Table A the leaded steel you want to investigate. (2) Enter Table B at the reference-group number for the steel—obtained in the right-hand column of Table A. (3) For the desired depth of cut and feed, pick out the cutting speed for a one-hour tool life. (4) To find the approx cutting speed for other tool lifes, use the conversion graph

leaded steel. Machining studies on a 0.4% alloy steel (see Example C-2 in the table) show that cutting speed for a given tool life increased from 110 to 190 fpm (about 75%) when the leaded grade was machined. Here the overall production increase was 56%.

Increased cutting speeds

Zlatin and Gould (*ASME Trans*, May '59) showed that, for a 60-minute tool life, the cutting speed of carbide tools could be raised from 150 to 200 fpm (about 30%), when 0.15 to 0.30% lead was added to AISI-4147 steel. One striking feature of this test was the reduction in the coefficient of friction: 20 to 35% less (see graph on p 115).

Other tests, aimed at a 20-minute tool life, showed that cutting speed could be raised from 275 to 325 fpm —a 15% increase. Lead also improved surface finish from 90/100 micro-in. to 65/70 micro-in. under identical cutting conditions. At the same time, the power required dropped by 15 to 25%.

Still another case reported for Rycut 40 (modified 41L40) showed an improvement in cutting speed from 105 to 195 fpm (almost 90%) for the same tool life when lead was added.

HSS tools work best

Increases in machinability are most striking when high-speed-steel tools do the cutting. With carbides, cutting-speed increases rarely exceed 35%. No data have yet been reported for cutting leaded steels with ceramic tools, but it is likely that some improvement will appear here also.

What cutting speeds can the shop expect to get with leaded steels? The two tables and the graph (at left) will help the estimator to find out, if he has no prior reference on a nonleaded steel. Good tooling practice should, of course be observed, and feeds generally should be a little heavier than normal. Specific power (horsepower per unit volume of metal removal per minute) is about 75% that of nonleaded steel grades, and the estimator should strive to put this excess machine capacity to use, either by increasing speed or increasing feed (or preferably both).

The cutting-speed tables at the left divide available grades of leaded steel into ten reference groups (see right-hand column of Table A). By entering Table B at the appropriate reference-group number, the estimator can get the cutting speed, for

a given feed and depth of cut, that will give a one-hour tool life. If he wants some other tool life, he can use the conversion graph (reproduced below Table A).

Troubleshooting

Leaded steel is no cure for all machining ills. If tools fail early in a standard steel because of excessive cratering, they will probably continue to fail in this way with leaded steel. Only a change in tooling can eliminate the trouble.

Nearly always, leaded steel machines with a better finish than the non-leaded grade of equivalent composition and hardness. If surface finish does not improve when a change is made to leaded steel, the user should make four tests: (1) Check the tool geometry, to make sure it is capable of producing a good finish. (2) Check to make sure that speed has been increased appreciably over the former speed—at least 20%. (3) Check the machine, to see if it is in sound condition. (4) Check for a built-up edge on the tool, because cutting speed may still be too slow.

Causes of chatter marks

If chatter marks appear during machining of leaded steel, the user should investigate any of six causes: (1) Check clamping of tool and workpiece for tightness. (2) Make sure the machine is in sound condition, capable of producing a chatter-free cut. (3) Make sure that tool and workpiece are free of cutting oil—remember, cutting oil keeps lead from doing its job. (4) Check to make sure that the tool edge is sharp and the tool face is highly polished. (5) Increase the rake angle five degrees or more, to take advantage of lower frictional forces and lower temperatures at the cutting edge with leaded steel. (6) Decrease the tool nose radius and increase end clearance.

Properly handled, leaded steels should be no more difficult to machine than other steels that a shop has been using.

Leaded steel offers no hazard whatsoever to the operator, unless he eats it in fairly large amounts! The only time leaded steel demands precaution is in welding, where the same safety measures should be taken as in welding galvanized steel: adequate ventilation is the most important. A quick spot check to determine the presence of lead in steel appears on p 115. •

Reprints

of this and all other AM/MM special reports are available from Reader Service Dept, American Machinist/Metalworking Manufacturing, 330 W 42 St, New York 36, NY. Single copies of this report are 25¢. (Price reduced for quantities over 100.) Other special reports: 16pp. 35¢; 12pp, 30¢ 8pp, 25¢. A list of current reprints is available on request.

LATEST DEVELOPMENT IN LEADED STEELS

By adding a small amount of the element tellurium to leaded steel, a major supplier has been able to boost machinability of steel even more.

Developed by Inland Steel Co, which supplies the steel in hot rolled bars, the new material is further processed by cold finishing at the La Salle Steel Co.

Machining speeds more than 3½ times as fast as the standard screw-machine steel (B1112) are reported for the new steel, called LA-LED X (LaSalle's standad leaded steel with a small tellurium addition). Reports La Salle: "This new steel has a machinability potential well beyond that of any present-day barstock."

Tests on new steel

Thoroughly tested before it was marketed, the new steel has been machined at speeds of over 600 sfm. Here are the results of tests run at the Cone Automatic Machine Co (Windsor, Vt):

During a two-week period, spark-plug shells were machined on a Cone six-spindle automatic screw machine. Tellurium steel from several different heats was machined from 13/16-in. hexagon barstock. (There were no great differences between heats.) Cutting tool for these tests was a high-speed tool (Grade T-5). Soluble-oil coolants were not required for the high speeds, but a light oil coolant was used.

After two weeks of preliminary runs—turning, shaving, reaming, drilling, and knurling—adjustments of the machine and tooling were made. Basic tests then began—at 528 sfm, or twice the normal operating speed of production shops that make spark-plug shells. At the same time, tool feeds were increased 1/3 over normal.

At this speed and feed the quality of the work was good, so speed was increased step by step to 618 sfm—or 3 1/3 times the machining speed of the standard steel B1112.

Tool wear during these tests was normal; the drills showed no appreciable wear.

Other test results

Extensive tests have been carried out in other shops. Here are examples:

- A machined part that had to be knurled, shaved, grooved, and tapered with two cross holes drilled was produced in 6½ sec. Production time for a comparable grade of leaded steel, the fastest machining steel available previously, was 12 sec.
- One shop normally operated a six-spindle screw machine at cutting speeds of 250 sfm. Material here was standard leaded steel. A switch to tellurium steel enabled the shop to boost speeds to 350 sfm.
- A producer of specialty fasteners increased cutting speeds from 275 sfm on leaded steel to 340 sfm on the tellurium-bearing steel.

Present supply limited

Although tellurium steel is expected to find wide use in Metalworking, the present limited supply of tellurium has restricted production of steel. Actually, the tellurium addition is very small: a few one-hundredths of one percent by weight. But tellurium, normally obtained as a by-product of copper and lead refining, is about as rare as gold. Success of the new steel will undoubtedly spur industry to develop new ways to extract more commercial quantities.

At present, Inland Steel is turning out only hot-rolled bars of tellurium steel. Cost of the tellurium addition amounts to an additional $15 a ton for carbon steels and $20 a ton for alloy steels.

Additional development work is now being carried out, both on other grades of steel and other machining operations.

Data on tellurium

Like lead, tellurium improves the machinability of steel by acting as an internal lubricant. Chips during cutting are small, falling away from the tool and reducing heat buildup.

Other principal uses of tellurium: in the electrical industry, for thermo-electric devices and semi-conductors; in rubber curing; in lead alloying for certain types of batteries; in electroplating baths as a brightener.

1961 METAL SHOW

Detroit, October 23-27

Education in materials application will receive more emphasis than ever at the 1961 Detroit Metal Show, to be held October 23 to 27 in the Motor City's new Cobo Hall. Here, for the first time in many years, all 275 exhibits and most of the 62 technical sessions will take place under one roof at the show sponsored by the American Society for Metals.

The show's educational theme will shape up around a dramatic ASM Materials Application Center (see sketch, right). Here, in the 12,000-sq-ft exhibit area, seven groups of engineering materials will be available for comparison in specific property categories. Many sample parts, components, and test specimens will be assembled under the 30-ft arches of the Metal Show Quadrilon.

Actually, the show should be an educational "short course" for metalworking executives, engineers, production, purchasing, and sales personnel, because the ASM has encouraged all exhibiting companies to staff their exhibits with engineering experts who are able to demonstrate new processes, answer specific technical questions, and help solve the individual materials problem of visitors.

Spokes from quadrilon

Seven pavilions, one for each materials group, will radiate from the quadrilon like spokes of huge wheels. As visitors proceed through the pavilions, they will see what each materials group has to offer in specific properties categories. In addition, they will be able to compare all the materials groups for specific properties.

Each pavilion will be roofed with symbolic girders and be color coded.

Materials groups include wrought ferrous, wrought nonferrous, cast ferrous, cast nonferrous, special purpose, nonmetallic, and composite.

Properties categories are strength, high temperature, corrosion resistance (atmospheric), corrosion resistance (processing), fatigue, low temperature, and general.

Materials application center brings together samples of seven groups of engineering materials so that six specific properties can be compared. The 30-foot arches of Metal Show's quadrilon—which houses the application center—serve as a nucleus from which 11 exhibitor categories extend like spokes of a huge wheel

This year ten American technical societies and trade associations will be participating in the Metal Congress, held annually with the Metal Show. T C DuMond, who has charge of technical sessions, says that this marks the largest number of societies ever to participate in this type educational event.

In 62 half-day sessions, the latest advances in engineering materials and materials processing will be reported. Everything from metal producing to atomic energy—including processing, testing, plastics, auotmobiles, aerospace vehicles, and instruments—will be covered in more than 250 papers.

The Congress begins Saturday, October 21, with the annual ASM Seminar. "Ultra-High Purity Metals" is the topic to be discussed at the two-day event.

A special session—to be held Friday, Oct 27—will cover the viewpoints of the scientist and the engineer, the problems of the patent office, and government responsibilities.

Societies participating in the Metal Congress are: American Society for Metals (31 sessions), Metallurgical Society of AIME (23 sessions), Society for Nondestructive Testing (8 sessions), American Welding Society, American Gas Association, Industrial Heating Equipment Association, Metal Powder Industries Federation, Metal Treating Institute, Special Libraries Association, and Ultrasonic Manufacturers Association.

The last seven of these will participate in joint sessions with the ASM.

Precision photo contest

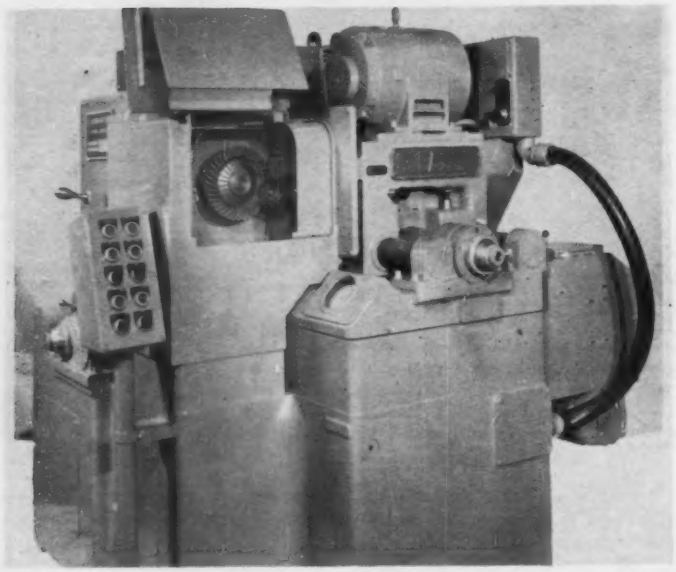
In its annual Metallographic Exhibit, the sponsoring ASM will display hundreds of outstanding metallographs from many parts of the world. Entries will compete for the $500 Francis F Lucas Metallographic Award.

Judging will take place in 14 separate classifications with "best of class" medals and blue ribbons awarded in each. The Lucas Award, named for the late pioneer metallographer represents "best in show."

Metalworking awards given

Six major metalworking awards of the American Society for Metals will be presented Monday, Oct 23, at the Awards Dinner, said to be a highlight of the 1961 show. Eight additional awards will be given at other special events during the week.

1961 Detroit METAL SHOW IN PRINT



Gleason Lapper Produces Smoother Gears With Swing-Pinion-Cone Motion

New concept in tooth lapping is incorporated into the model 503 hypoid lapper to give gears exceptional smoothness and quietness.

The concept, known as swing-pinion-cone lapping consists of automatically and continually swinging the pinion head about a vertical axis which passes through the center of the tooth wash while the gear and pinion are rotating in a flow of lapping compound.

This swinging motion moves the tooth bearing contact across the entire length of the tooth surface.

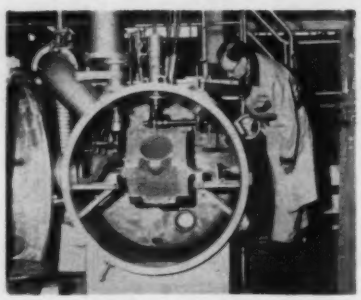
At the same time, axial motion of the pinion moves the tooth bearing up and down the tooth profile while movement in the direction of the gear axis maintains constant backlash.

The compact lapper is designed primarily for lapping automotive spiral bevel and hypoid gears and pinions that will operate at a 90-degree shaft angle.

It will handle hypoid gears up to 10½ in. diameter and miter gears to 6 in.

Gleason Works, 1000 University Ave, Rochester 3, NY

MORE DATA? Circle 150, inside back cover



Vacuum Melting, Heat Treating Furnaces Shown in Stokes Display

Research and development furnace has a transparent full opening lid on its alloy additions chamber to permit continuous observation of the additions procedure. The alloy-additions system contains four 36-in buckets and one 200-cu in. bucket enclosed in a single chamber together with a vibrated trough and chute. Buckets can be emptied into the chute in any sequence with external handles located at the operators position on the control platform. A 4-in. ball valve has been added to the line connecting the additions system to the melting chamber, replacing the normal gate valve. This eliminates valve clogging from small pieces of alloying material or dirt. Capacity of the vacuum furnace is 50 lb.

The company will also display the Model 435-585 heat treating furnace designed to fill the gap between small laboratory furnaces and large production units. The –585 has a hot zone 11 in. in dia and 12 in. high surrounded by molybdenum heating elements. Max temperature is 1650 C.

F J Stokes Corp, 5500 Tabor Rd, Philadelphia 20 Pa

MORE DATA? Circle 151, inside back cover

Graco Hydraulic Mastic Sprayer Automatically Clears Clogged Tips

Hydra-mastic spray unit hydraulically sprays mastic materials with 3,000 psi pressure and has a specially

designed tip holder that allows operator to unclog the tip by flipping a lever. This reverses the tip so that the clogging material is freed. A short squirt cleans the tip and the lever is then returned to normal position.

Company will display its complete line of airless spray equipment including the new FF tip in which an inner chamber has been added that has a larger orifice than the outer. This gives double atomization and produces an extra-high-gloss finish.

Eleven models of the hydra-spray ranging from 5 to 55 gallons plus standpipe models for paint circulation systems are included in the line. Quantity capacities range from one quart to unlimited quantity circulations systems. Pressures range from 1400 to 3000 psi.

Gray Co, Inc, Graco Square, Minneapolis 13, Minn

MORE DATA? Circle 152, inside back cover

Tubing Produced to Exact OD, Wall Thickness Specifications

Ceram-spun process of producing steel tubing allows engineers to specify the exact outside diameter and wall thickness of tubing to meet specific design requirements for high pressure, high temperature piping and for tubular mechanical components such as rolls and hydraulic cylinders.

Process consists of using ceramic-lined metal flasks for casting the molten steel or other metal compositions. By varying the thickness of the ceramic lining, outside diameters from 2.25 in to 50 in. can be produced with wall thicknesses from ¼ to 8 in.

Standard length is 20 ft but shorter lengths can be supplied at higher cost. Outside surfaces can be finished to 1 to 2 micro-inch and inside surfaces to 8 to 16 micro-inch.

American Cast Iron Pipe Co, Birmingham 2, Ala

MORE DATA? Circle 153, inside back cover

Paint Withstands 2500 F Heat

Pyromark, a high temperature paint that can be applied like ordinary paint by spraying or brushing will survive temperatures of 2500 F after a preliminary cure at 400 to 600 F. Heat shock resistance is said to be excellent after cure and adhesion at high temperatures is reportedly good enough to allow the paint to remain on some metals up to their melting point.

The paint is available in black, white, gray, maroon, blue, and green.

Tempil Corp, 132 W 22 St, NY 11, NY

MORE DATA? Circle 154, inside back cover

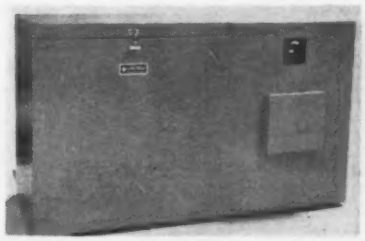
Hayes Exhibits Instrument Dryer, High Purity Open Chamber Furnace

High-purity open-chamber furnace for tool hardening, brazing, sintering, and general heat treating problems is said to give faster temperature response and to maintain low dew points necessary for heat treating tool steels.

Also being shown is the model DBB instrument air dryer, which is designed to produce effluent dew points of −85 F at air pressure of 100 psig. The unit, known as the Molecu-Dryer is wall mounted and features module construction.

C I Hayes Inc, 811 Wellington Ave, Cranston, RI

MORE DATA? Circle 155, inside back cover



Cincinnati Sub-Zero Units Cool 200 lb of Steel/hr to -120 F

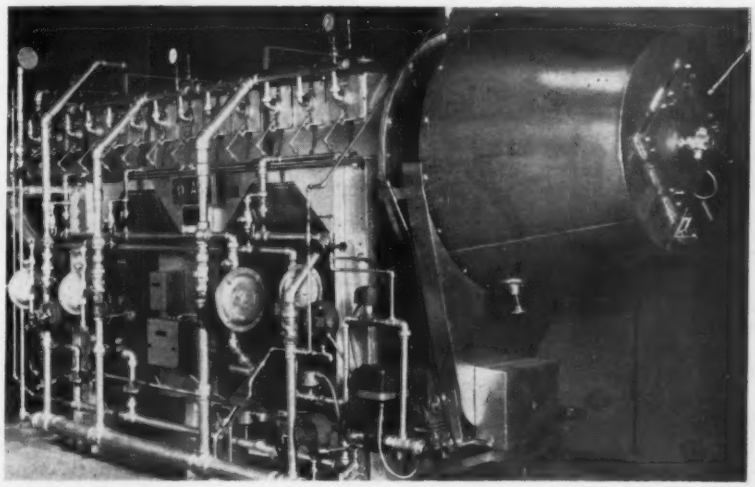
With a chamber that measures 36 by 24 by 30 in. the model ST-120-15 will chill 200 lbs of steel per hr from ambient to -120 F.

Capacity of the steel low-temperature unit is 4000 btu/hr at -120 F, operating on a 440-60-3 power source with a 115 v control circuit.

With an adjustable temperature control and a range from ambient to -150 F the unit can serve as a stabilization, tool treatment, expansion assembly and stress relief chamber.

Cincinnati Sub Zero Products, 3932 Reading Rd, Cincinnati 29, Ohio

MORE DATA? Circle 156, inside back cover



SUPERIOR PROCESSING UNIFORMITY is said to be gained by the AF Automotion furnace which keeps parts continuously in motion during heating, exposure to atmosphere, and quenching. Motion of the parts in the furnace retort gives each part the same heat and exposure to the atmosphere and motion of the parts in the 22½-in-dia rotary quenching drum gives uniform hardness—*American Gas Furnace Co, 1004 Lafayette St, Elizabeth, NJ*

MORE DATA? Circle 157, inside back cover

1961 Detroit METAL SHOW IN PRINT

Bausch & Lomb Shows Low-Cost Optical Measuring and Scratch Inspection Gages

Designed for inspection of materials where scratches exceeding certain limits could result in structural failure, this low-priced scratch gage (left) gives measurements of ±0.0001 in. or 5% of the depth whichever is greater, on indentations with depths from 0.0002 to 0.016 in. Widths from 0.001 to 0.050 in. can be determined to 0.001 in. The same measurements apply to raised portions and, in addition to measurements, the gage shows the contour of the indentation.

Operating on 115 v, 50 to 60-cycle ac, the unit has a removable flat base so that special adapters can be attached for tube o rord inspection. Nylon pads on the base minimize further scratching.

Price of the gage is $278 including batteries and case, transformer is optional at $46.50.

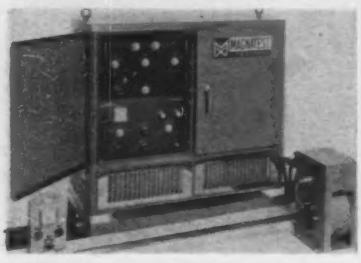
Shown at right is the company's optical inspection gage which is accurate to 0.000025 in. and operates within normal temperatures (50 to 90 F) without correction tables. Over a temperature range of 31 to 105 F the maximum correction for a 3-in. dimension in steel is 0.0001 in.

The instrument is supplied with an anvil adapter to accept any standard anvil or special fixture. A 3½ -in dia circular or a 4 by 6 in. rectangular anvil are also available.

Price of the standard model is $875.

Bausch & Lomb Inc, Rochester 2, NY

MORE DATA? Circle 158, inside back cover



Magnaflux Displays Line of Nondestructive Test Equipment

One of a line of non-destructive testing instruments displayed by the company, the SD-100 series automatic inspection system will eddy-current- test electric-weld tubing from ¼ to 2½ in. OD. Butt-weld pipe from ½ to 4 in. OD can also be inspected in the machine, which is housed in a floor mounted enclosure measuring 42 by 30 by 22 in.

Other equipment includes:

Compact 900-amp magnetic particle test unit; a 70-lb tester designed to fit through narrow openings so that testing can be done by one man in normally inaccessible areas.

Series ED-600 eddy current crack detection and sorting unit designed for locating and determining the relative severity of cracks in non-magnetic metals. Unit has a lift-off or intermediate layer compensation on the probe which reduces spurious meter deflections due to probe positioning, surface roughness, dirt, or pitting.

FM-610 magnetometer / gradiomenter for measuring dc magnetic fields.

Magnaflux Corp, Subs of General Mills, 7300 West Lawrence Ave, Chicago 31, Ill

MORE DATA? Circle 159, inside back cover

7½-oz Vibrolator Gives Stepless Frequency Control to 22,000 cpm

With infinitely controllable frequencies from 0 to 22,000 cpm the BD-13 7½-oz vibrolator will handle up to 10-cu-ft-capacity bins. A chrome steel ball driven in an orbit on replaceable ways of hardened alloy steel allows the unit to be used in high ambient temperatures and explosive atmospheres. A special lug design permits mounting in any position with a single bolt.

Maximum air consumption of this model is 6 cu ft per minute (free air at 80 psi) and it will operate on as little as 5 psi. Price is $16.95; all brass stepless control regulator is $6.00.

Martin Engineering Co, Neponset, Ill

MORE DATA? Circle 160, inside back cover

Pressure Sensitive Tapes, Taping Machines at 3M Exhibit

Scotch brand Loktac tape, a special thermosetting adhesive transfer tape. Scotchfoam No Y-9063 a double-faced foam tape with high-tack adhesive, and Scotch brand No. Y-9052 vibration damping tape are among the new products in the company's display. Special electroplating and metal bonding tapes as well as tapes for masking, printing and nameplates will also be shown.

New machinery shown includes a motorized box sealing machine, and an automatic definite length tape dispenser.

Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 161, inside back cover

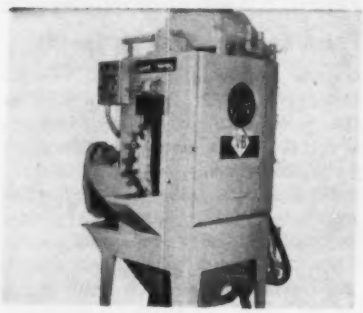
Riehle Displays Fatigue Testing Machine, Line of Hardness Testers

Exhibited with an automatic programmer, the new hydraulically actuated fatigue testing machine can apply alternating tension and compression loads to specimens as well as entire structural components.

A universal tester with recording equipment will be shown, as well as hardness testing equipment formerly made by Steel City Testing Machines and Torsion Balance Co.

Riehle Testing Machines Div, American Machine & Metals, Inc, East Moline, Ill

MORE DATA? Circle 162, inside back cover

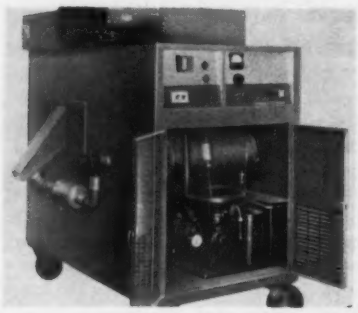


Vapor Blast Machine Cleans Parts With Fixed and Oscillating Guns

Special vapor blast machine has constantly rotating, vertical turntable with variable speeds and magnetic holding fixtures. Fixed blasting guns inside the machine are directed at specific areas on parts to be blasted and oscillating guns play across the width of the turntable fixture.

Vapor Blast Mfg Co, 3025 W Atkinson Ave, Milwaukee 9, Wisc

MORE DATA? Circle 163, inside back cover



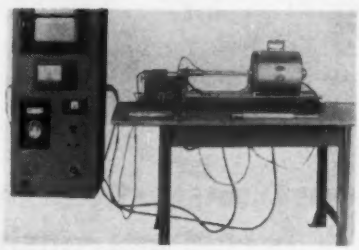
Ultrasonic Cleaning Machines Use Captive Air To Retain Solvents

Ultrasonic cleaning machines employing a new system of retaining solvent cooking enables an operator to use expensive solvents such as Freon without saturated deactivated charcoal. The system uses alternately cooled and heated air to retain the solvent in the machine as it dries the cleaned parts. Since the system is sealed, solvent loss is minimized and new air cannot enter. In addition the solvent is continually being purified for re-use.

Two models of the new machines are being shown by the company, the Multi-Wheel model 36-6 and the MonoWheel Model 18. Both of these machines can take parts directly from production machines or from a vibrating hopper.

AutoSonics, Inc, 4217 Chestnut St, Philadelphia 4, Pa

MORE DATA? Circle 164, inside back cover



Brinkmann Displays Simplified And Automatic Dilatometers

Dilatometers for studying the thermal characteristics of metals, ceramics, cermets, glass and glass metal combinations are offered in two styles; fully automatic TO and simplified OH. These units are supplied with SIC furnaces operating at temperatures up to 1550 C or with a rhodium furnace for 1800 C maximum temperature or a Kanthal wound furnace for 1320 C.

Main components are the furnace, a transducer or dial gage for measuring or recording, a two-pen strip chart recorder which makes the expansion curves, a baseplate and a stage or hand operated regulating transformer. On the fully automatic style, an automatic program controller maintains a stepless selected rate of heating or cooling within a reported accuracy of 1%. It also provides for automatic shutoff when preset temperature is reached.

Brinkmann Instruments, Inc, 115 Cutter Mill Rd, Great Neck, LI, NY

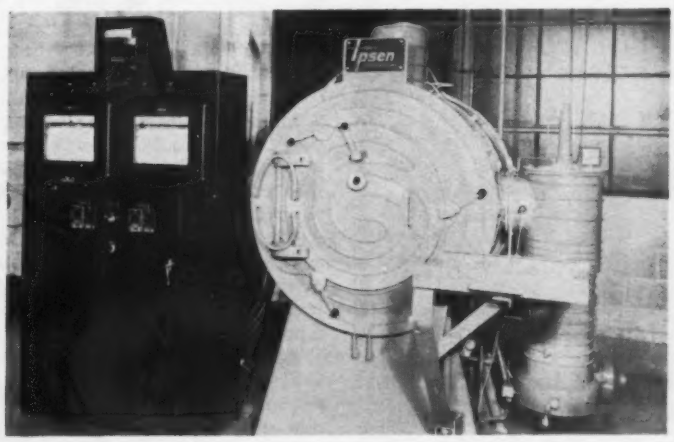
MORE DATA? Circle 165, inside back cover

Detroit Hinge Shows Heavy Duty Line of Industrial Hinges

New line of heavy-duty industrial hinges includes continuous hinges manufactured of 3/16 and ¼ in. plate steel with pin diameter up to ⅝ in. Also displayed are heavy duty strap hinges of ¼ in. plate. These include hinges with straps from 8 to 20 in. long and from 2 to 2⅞ in. wide. All heavy duty strap hinges have a hardened steel thrust washer.

Detroit Hinge Mfg Co, 1632 W, Lafayette, Detroit 16, Mich

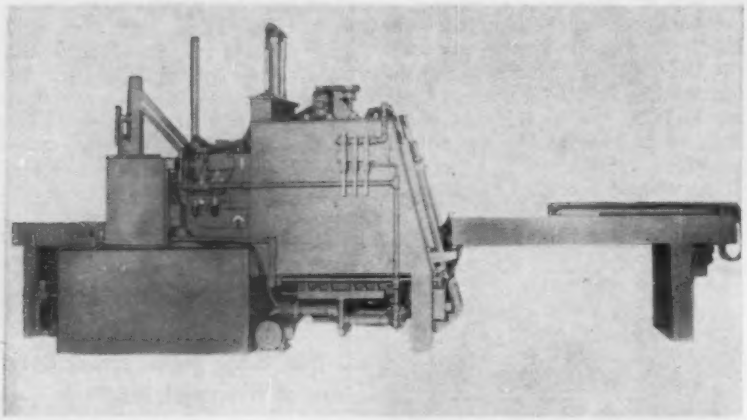
MORE DATA? Circle 166, inside back cover



FAST HEATING UP TO 2400 F coupled with fast cooling is obtained with the VFC—150, high-vacuum heat treating unit. Furnace has a work space 15 in. wide, 24 in. deep, and 10 in. high. Maxmum vacuum is 0.1 micron Hg and operating pressure of 1 micron Hg is reached in about 15 minutes. Instrumentation includes recording Vacutronic which measures and controls pressure from 0.1 micron Hg to atmospheric, or partial pressures of inert gas—*Ipsen Industries, Inc, Rockford, Ill*

MORE DATA? Circle, 167, inside back cover

1961 Detroit METAL SHOW IN PRINT

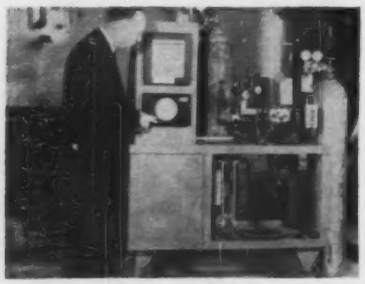


Sunbeam Furnace Keeps Transfer System From Heat When Work is Not in Transit

Patented transfer system of the new AF casemaster furnace is designed so that no part of the furnace transfer system is exposed to heat except when the work is being transferred. The furnace can be used for atmosphere-controlled carburizing, carbonitriding, carbon restoration normalizing, annealing, and hardening in a tempearture range from 1400 to 2000 F. Built in five standard sizes from 12 by 12 by 18 to 30 by 24 by 48 in., the furnaces have production ranges ranging from 100 to 1000 lb of work per hr.

Sunbeam Equipment Corp, 168 Mercer St, Meadville, Pa

MORE DATA? Circle 168, inside back cover



Perkin-Elmer Analyser Records, Controls Furnace Atmospheres

Accurate analysis and control of atmospheres inside a metal-treating furnace are possible with the new furnace analyser. The analyser gives readings of four atmosphere components—in the case of one installation, carbon dioxide, methane, nitrogen and carbon monoxide. The unit controls critical carbon dioxide concentration in this installation to 0.02%.

Analyser operates by sweeping atmosphere samples through a sensing unit containing a length of tubing known as a chromotographic column. The column separates the gases into components and the concentration of each gas is measured as it leaves the column. This information is transmitted to a recorder which indicates volume percentage.

A programming device controls the sensing unit and recorder and delivers an electrical output to a unit that senses and stores the peak value of a predetermined component. This value is then available as a signal for the control system.

Illustrated above is a portable version of the standard analyser mounted on a mobile cart.

Perkin Elmer Corp, Norwalk, Conn

MORE DATA? Circle 169, inside back cover

Plasmarc Weld Surfacing Deposits Fused Coatings At High Speeds

Shown depositing Stellite 157-m on the periphery of ⅛-in. thick 4 in. dia mild-steel disc, the Plasmarc weld surfacing unit can deposit a very thin fused coating with controlled dilution at high speeds. The overlay metal is fed as a powder into the Plasmarc torch and heated by a constricted plasma arc that is produced in the torch and transferred from the torch to the work. Argon gas used in forming the plasma shields the surfaced area form the atmosphere.

With this equipment penetration of the overlay into the base material can be held to 0.005 in., dilution of the overlay can be controlled from 5% to 50%, overlays can be produced from 0.010 to 3/16 in. thick in one pass, and 6 lb of metal per hr can be deposited at an efficiency of 95%.

Linde Co, Div of Union Carbide Corp, 270 Park Ave, NY 17, NY

MORE DATA? Circle 170, inside back cover

Nickel Ball Anodes in Titanium Baskets Keep Constant Anode Area

Nickel Ball anodes 2-in in diameter contained in 11 commercially pure titanium baskets are said to maintain proper plating efficiency because they automatically maintain the proper anode surface. The nickel balls are stacked vertically in the non-corroding titanium baskets and, as the lower anodes corrode they feed downward to maintain the constant anode area.

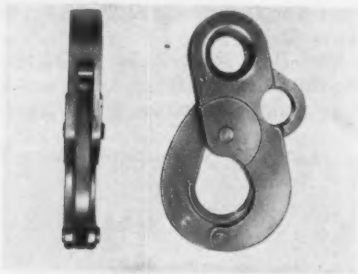
Since the anodes can be allowed to corrode completely this eliminates remelt of partially corroded anodes and allows longer plating times without maintenance shutdowns.

The nickel balls are available for

$1.01 per lb in lots of 60,000 lbs and up with prices slightly higher for smaller lots. Titanium containers cost $5 per foot including hook. Service life for the containers is estimated at 10 years.

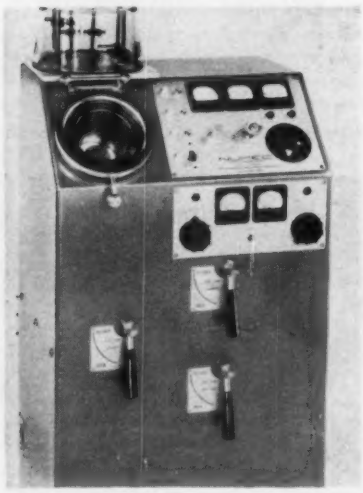
Univertical Corp, 14841 Meyers Rd, Detroit 27, Mich

MORE DATA? Circle 171, inside back cover



RELEAS-A-MATIC ALL PURPOSE HOOK can be released with a pull ring while loaded, permitting the operator to stand clear when unhooking live loads. A positive lock is also incorporated that prevents the hook from opening under any load conditions except when intentionally released. — *Merill Bros, Arctic St, Maspeth, NY*

MORE DATA? Circle 172, inside back cover



Cathodic Vacuum Etcher Produces Etched Specimens in 1 to 6 min.

Etched surfaces that develop the structure of metals, ceramics, and cermets are produced in a few minutes with the Model 4CVE cathodic vacuum etcher. Cathodic vacuum etching consists of making a specimen the cathode in a vacuum glow discharge so that when it is subjected to positive ion bombardment material is dislodged from its surface in a pattern related to its microstructure. This system is said to be cleaner and to reveal more detail than other forms of etching and, in addition, is suitable for etching toxic materials in a glovebox or radioactive materials remotely in a hot cell.

Model 4CVE attains a vacuum of 25 to 300 microns with a diffusion and force pump. Its variable power supply can give up to 5000 v 50 ma rectified dc current from a power source of 110 to 125 vac. The etcher, which is said to be simple enough in operation so that unskilled persons can obtain good etches after a few hours training, handles samples ¾-in square or 1 in diameter.

Nuclear Materials & Equipment Corp, Apollo, Pa

MORE DATA? Circle 173, inside back cover

Wheel Trueing Lapping Compound Is Reformulated for Uniformity

Granulaide, a new surfactant developed to extend the life of Trulap lapping compound, evenly disperses small particles of diamond dust throughout the compound and keeps the compound from draining away. Diamond particles are kept uniform with no "spears" or "blades" to scratch the work. The reformulated compound is available in a micron range of 0-½ to 200 and mesh equivalent of 60,000 to 100. It is color coded to prevent misapplication.

Wheel Trueing Tool Co, 3200 W Davison, Detroit 38, Mich

MORE DATA? Circle 174, inside back cover

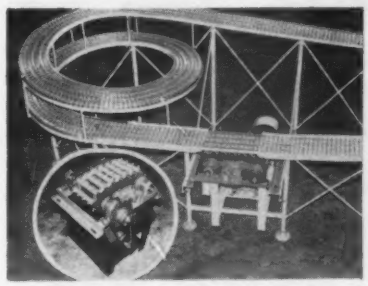
Compound Strips Epoxy Paints From Steel, Aluminum in 30 Sec

Haughto-Clean 224 will swell epoxy paint on steel and aluminum panels in 30 seconds so that it can be washed away with water. It is designed to replace hot caustic which has little effect on epoxy paint and actually destroys aluminum.

Other company products on display are Hocut 237, a water soluble chemical cutting compound that is transparent and has excellent wetting speed, and Rust Veto 342, a transparent heavy-duty rust-preventative that is said to be easy to clean off.

E F Houghton & Co, 303 W Lehigh Ave, Phila 33, Pa

MORE DATA? Circle 175, inside back cover



FLAT SURFACE TRACTION DRIVE will handle a total belt load of 325 to 500 lbs. Belt speeds up to 115 fpm are possible with the drive on belts up to 36 in. wide. For tier conveyor systems using multiple drive units clearance of 7½ in. plus the product height is provided—*Ashworth Bros, Inc, Winchester, Va*

MORE DATA? Circle 176, inside back cover

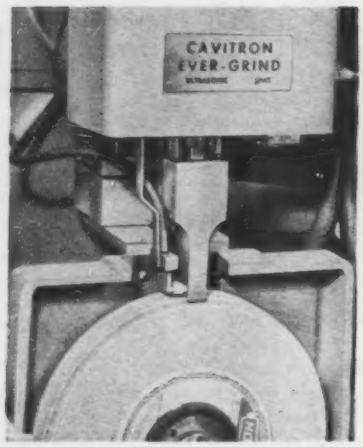
Harris Small Refrigeration Unit Holds —130 F Within 1 Degree

For small shops or laboratories the 2-cu ft refrigeration machine gives flexible service for metal treating, shrink-fitting, or environmental testing. Designated the Model 2L-2-075, it holds –130 F within 1 degree. The machine is protected against pressure build-up if power fails and will restart automatically when power is restored. Compressor compartment has two fans for cooling and insulation is rigid polyurethane foam.

Harris Mfg Co, Inc, 308 River St, Cambridge 39, Mass

MORE DATA? Circle 177, inside back cover

1961 Detroit METAL SHOW IN PRINT



Cavitron UltraSonic Attachment Prevents Grinding Wheel Loading

Evergrind uses ultrasonic cleaning to enable a wheel to grind cooler and cleaner. (AM/MM — Mar 20, '61, p124) A magnetostrictive transducer, driven by a generator operating on 60-cycle line current vibartes at 20,000 cps. This vibration is transmitted to an aluminum tool attached to the end of the transducer and positioned close to the grinding surface of the wheel. As coolant passes through the tool onto the wheel bubbles (cavitation) are induced within the agitated fluid and these simultaneously blast away metal buildup and cool the wheel. Because it prevents build-up of particles in the abrasive structure of the wheel Evergrind permits the use of finer and harder wheels with resulting finer surface finishes and greater accuracy.

Cavitron Equipment Corp, 51-02 21 St, LIC 1, NY

MORE DATA? Circle 178, inside back cover

Heil Fume Washers Give 99 to 100% Efficiency on Chromic Acid

Series 700 fume washers for chromic and other fumes, are available in 2000, 4000, and 7500 cu ft per minute sizes. The units are operated by a single motor directly connected to the power wheel and is easily accessible for maintenance. The washers are made of mild steel, but are available in solid plastic or lined steel construction if desired.

Said to be proven 99 to 100% efficient in chromic acid and other fumes they allow the cleaned air to be discharged inside the plant, state codes permitting, thereby saving in plant heating costs.

Heil Process Equipment, 12901 Elmwood Ave, Cleveland 11, Ohio

MORE DATA? Circle 179, inside back cover

Jiffy Disintegrator Redesigned With Lighter Table, Longer Reach

Redesigned Model C-2 disintegrator is lighter by 140 lbs than the Model C-1. Much of the weight saving is due to use of the company's metal called Tenzaloy. Other improvement is a new radial arm that sweeps the entire area of the top late, and which can be locked by a finger touch. This arm consists of two separate sections that buckle together for close work or open up of an extended arm. For extremely close work one section can be removed entirely, and for extra extension a third section can be added.

Jiffy Tool Supply Co, Inc, 1503 E Eleven Mile Rd, Royal Oak, Mich

MORE DATA? Circle 180, inside back cover

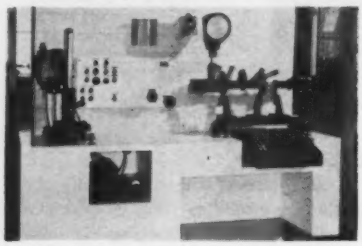
Hevi-Duty Exhibits Induction Furnace, Dew Point Instrument

Portable dew point instrument gives direct readings without conversion to accuracies of 0.000035 by volume or 0.00015 grains per cut ft at the lower end of the range. In addition the range of the instrument has been extended down to −90 F which is said to be 40 to 50 degrees below that of current commercial instruments.

The company is also showing a new low-frequency induction furnace for melting aluminum and other light alloys. The furnace is one of a line of induction melting furnaces and receivers that the company is manufacturing in the US under license form Forni Elettrici A Tagliaferri, Milan, Italy.

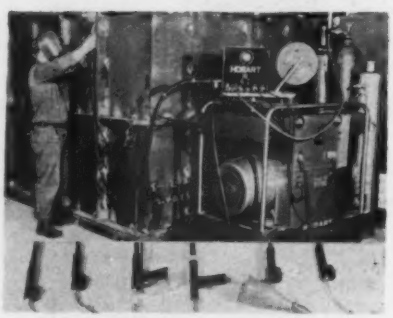
Hevi-Duty Electric Co, 304 Hart St, Watertown, Wisc

MORE DATA? Circle 181, inside back cover



METALLOGRAPHIC INSTRUMENTS include automatic microtome, vacuum heating stage with a range of 1800 C for rapid heating and cooling of samples under microscopic observation. Other equipment on exhibit includes a microhardness tester which measures the hardness of a single crystal, an electronically controlled dilatometer and a new vacuum thermobalance—*William J Hacker & Co, PO Box 646 West Caldwell, NJ*

MORE DATA? Circle 182, inside back cover



Hobart Multi-Wire Welder Uses All Semi-Automatic Processes

Multi-wire welder with a family of welding guns will handle all of the new semi-automatic welding processes. By changing guns an operator can use the welder for small wire all position gas shielded welding, large wire CO_2 welding, combination tubular or fluxed wire and CO_2 gas shielded welding, inert gas shielded metal arc process for nonferrous

metals including aluminum Migarc, fabricated or tubular wire process not using gas shielding, hard surfacing, and submerged arc welding.

The welder, which is mounted in a carryall truck, consists of a motor generator power source rated at 500 amp dc at 40 volts with 100% duty cycle, a selection of welding guns and cable accessories and a water cooling circulator. The circulator is a self-contained system with the pump housed in the tank so that it can be plugged into the front of the welder without special plumbing for those jobs that need water cooling of the gun.

In addition to design of the six different gun and cable assemblies for particular processes, all volt-amp slopes are factory preset and do not require change for any of the semi-automatic welding processes.

Hobart Brothers Co, Troy, Ohio

MORE DATA? Circle 183, inside back cover

Weltronic System Allows Factory Control From Central Room

Plant central control system enables management to control and dispatch maintenance, truckers and other types of help, expedite a job, tell how long before the job is finished, control tools and operations, and record and plot conditions for production and payroll.

Basic hardware for the system consists of:

A machine control box located at each work station in the plant. This box has lights to indicate various conditions, a selector to indicate kind of help required, and a jack for a plug-in phone.

A machine control panel (20 per cabinet) for each work station located in a central control room. This has meters to record time and pieces, a display unit to indicate conditions at the machines, and an indicator for recording information.

Other equipment in the system includes a plant sound system, a plant confidencer phone system, and audio and visual signals for tool controls.

Weltronic Co, 19500 W Eight Mile Rd, Box 127, Southfield, Mich

MORE DATA? Circle 184, inside back cover

Furnace Gas Analyzer Records Quantity of Eight Components

Model 1010 furnace gas analyzer gives a complete quantitative analysis of 8 components in a gas mixture every 5 minutes or less. The components that are analyzed and recorded on the principle of gas chromatography are hydrogen, oxygen, nitrogen, carbon monoxide, carbon dioxide, methane, and water vapor.

The ruggedly built unit has no delicate optics or glassware and is designed for heat treating furnaces, annealing lines, blast furnaces and gas generators.

Research & Control Instruments, Inc, Woburn, Mass

MORE DATA? Circle 185, inside back cover

Artco Tenzalloy Fixture Bases Have 100 Micro-in. Edge Finish

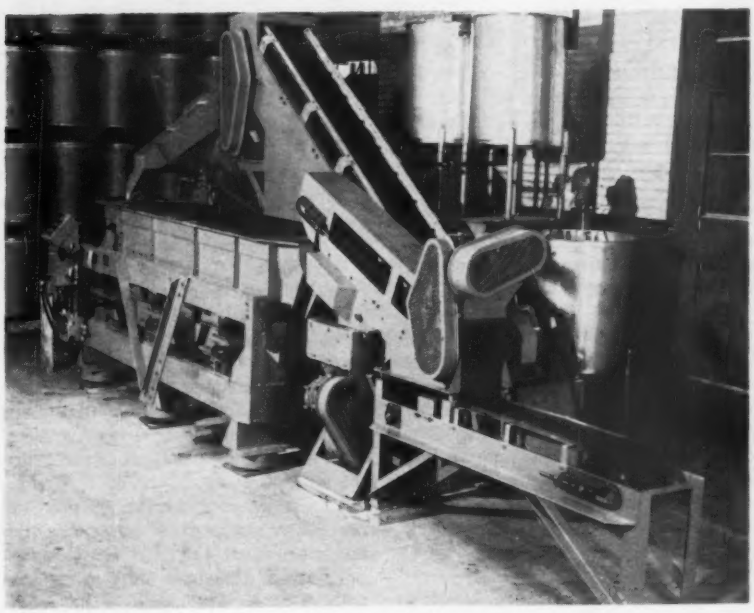
Line of fixture bases made of Tenzalloy are ground to a micro-finish of 100 with one edge; one end and the lower pads are machined to a tolerance of 0.002 in. in any sq ft, 0.005 in. in any 4 ft length, and 0.003 in. parallelism of top and bottom surfaces. The ribbed fixtures are available in 142 sizes from 8 by 8 in. through 28 by 72 in.

Artco Inc, 31985 Groesbeck Hwy Fraser, Mich

MORE DATA? Circle 186, inside back cover

NO 11 SPEED CUT abrasive cutoff machine uses an 11-in diameter wheel and is equipped with a 4-hp motor. Capacity of the machine is 3 in. in shapes and 1½ in. in solid steel —*Beaver Pipe Tools Inc, Warren, Ohio*

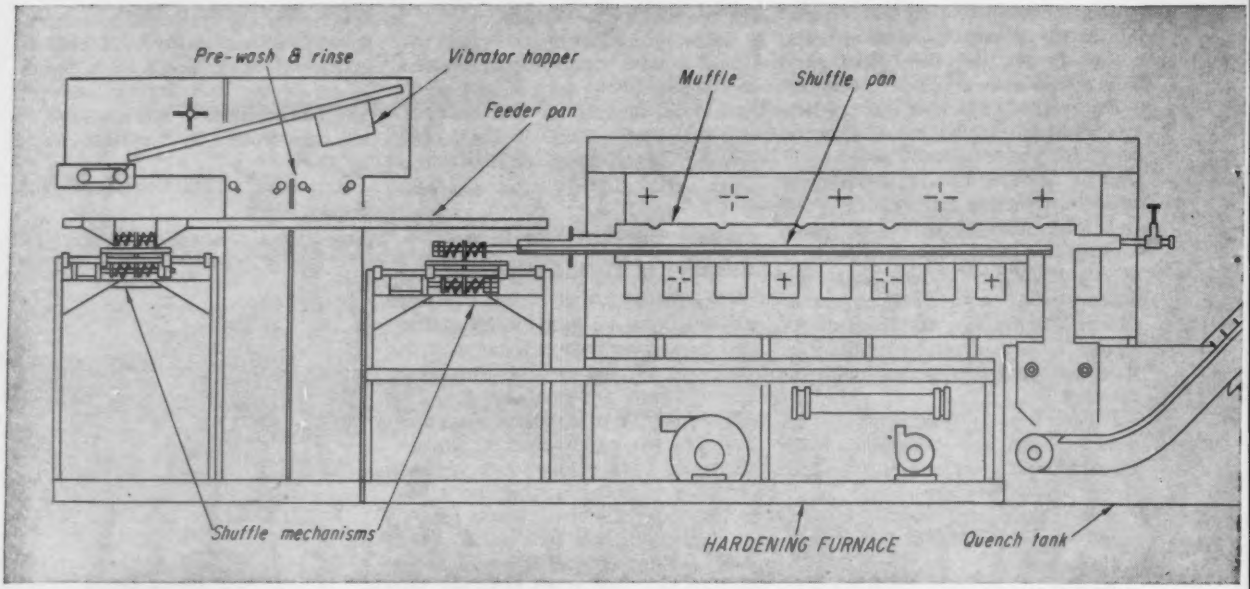
MORE DATA? Circle 187, inside back cover



CONTINUOUS PROCESS VIBRATORY GRYATOR is fully automatic so that work may be fed or conveyed into and out of the machine, cleaned, screened, and recirculated and water and compound added without manual operation or supervision—*Pangborn Corp, Hagerstown, Md*

MORE DATA? Circle 188, inside back cover

(Section continued on p 214)



Automatic heat-treating line, one of twins, consists of a 900-lb/hr shuffle-hearth furnace, a draw furnace, pre-wash and rinse units, and automatic quenching equipment. Other equipment includes shuffle mechanisms and conveyors

Twin lines speed heat treating

By W Wilson, plant manager
and Carl R Suter, mfg superintendent
SKF Industries, Inc, Altoona, Pa

Two heat-treating lines are better than one, to paraphrase the old saying. Naturally, two lines can handle twice the volume, or can handle two different parts at the same time. But the twin Sunbeam heat-treating lines at our new Altoona ball bearing plant go even a step further: Each of the two lines can process two different parts simultaneously.

Flexibility is important because we heat treat the inner and outer races for some twenty different sizes of ball bearings. But flexibility is only half the story. These races are hardened, quenched, washed, and tempered—yet the only manual handling required is at the very start and at the finish of the heat-treating process.

Dual shuffle pans

Each line consists of a 900-lb/hr shuffle-hearth furnace, a draw furnace, pre-wash and rinse units, and automatic quenching equipment. And for maximum flexibility, both lines have dual shuffle pans and conveyors. This means that either line can handle two different parts—at different feed rates — at the same time. The shuffle-hearth furnaces operate at 1500 to 1800 F; the draw furnaces at 200 to 950 F.

Let's follow a load of bearing races through the complete heat-treating process. The machined races are first loaded into tote boxes in the machining department and brought to the furnace by lift truck. The furnace operator feeds the races onto a conveyor which then carries them up to a hopper.

A vibratory feeder then moves the races through a retarding wheel to a metering belt. This belt moves the races through a chute to the wash shuffle pan which, in turn, feeds the hardening furnace. (For simplicity, we'll discuss just one of the two lines. They are identical; so anything said of one applies just as well to the other.)

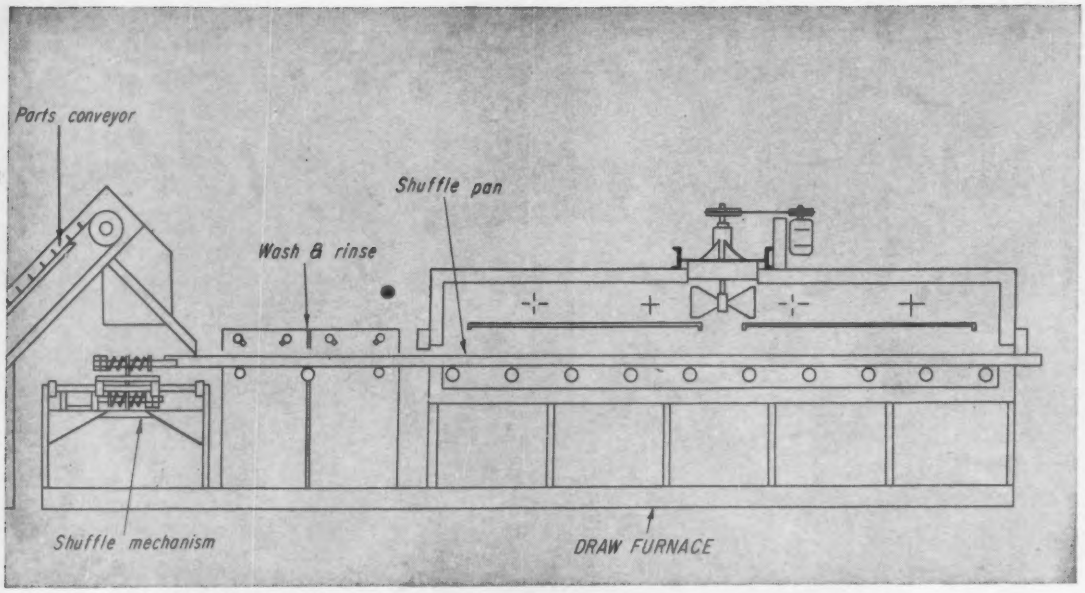
The races are now on the feeder pan. This takes the races to the charging entrance of the twin-muffle hardening furnace and onto the shuffle pans, which move the races through the furnace. Each shuffle pan has an effective heating surface 24 in. wide by 10 ft long, and a working height of 3¼ in.

An external, air-operated mechanism shuffles each work pan back and forth in the bottom of an alloy muffle, thereby moving the races through the furnace at a controlled speed. A separate shuffle mechanism serves each muffle, so that different feed rates may be established for each shuffle pan. Both the amount of forward travel imparted and the time interval between strokes of the shuffle mechanism are adjustable.

Automatic oil quench

On emerging from the hardening furnace, the bearing races drop vertically into an automatic, 1000-gallon-capacity oil-quenching tank. The discharge chute of the furnace extends below the oil level to prevent any outside air from entering the furnace and contaminating the furnace atmosphere, and a vapor exhaust system prevents oil vapors from backing up into the furnace muffles. The entire quenching section is protected by an overhead dry-CO_2 automatic fire-protection system.

Quenched races drop onto a flighted conveyor belt that carries them out of the quench tank and onto the shuffle feed pan that takes them through the washing and rinsing equipment. The combination wash-and-water-rinse system removes the quenching oils before the races pass into the draw furnace. As the races



leave the quench conveyor they pass onto the draw furnace pan, which is perforated at the washing and rinsing stations. Overhead nozzles spray washing and rinsing solutions on the races as the shuffle pan moves them along.

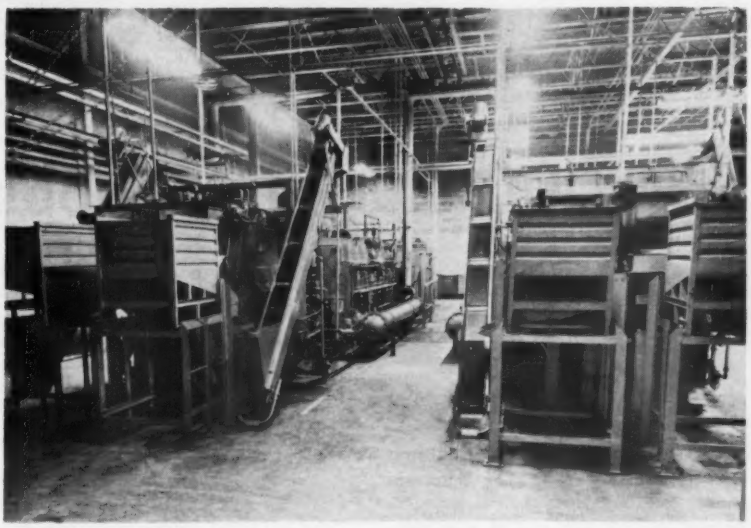
Into the draw furnace

The washed and rinsed races now move into the draw furnace, where twin shuffle pans riding on free-turning rollers carry them through the operation. Uniform heating is assured by firing the burners into a combustion area above a horizontal baffle. The baffle directs the air past the burners to opposite ends of the baffle before it is returned through the work area, thus eliminating any direct radiation to the work and providing a constant flow of recirculating air.

Atmosphere, temperature controls

Atmosphere for the two shuffle-hearth furnaces is supplied by two Sunbeam 2000 - cubic - feet - per - hour Endogas generators. This protective atmosphere consisting of 40% nitrogen, 40% hydrogen, and 20% carbon monoxide, protects the bearing races from oxidation and decarburization.

All temperatures are registered and recorded on two control panels. Pushbutton control lights represent the operating elements of the heat-treating lines and indicate their operational status. Temperatures in the draw furnaces are automatically controlled by strip-chart time proportioning controllers. All instruments are equipped with thermocouple fail-safe devices, and each control zone has over-temperature protection. The draw furnace starts up at the push of a button. Each of its burners is supervised by an electronic control system.

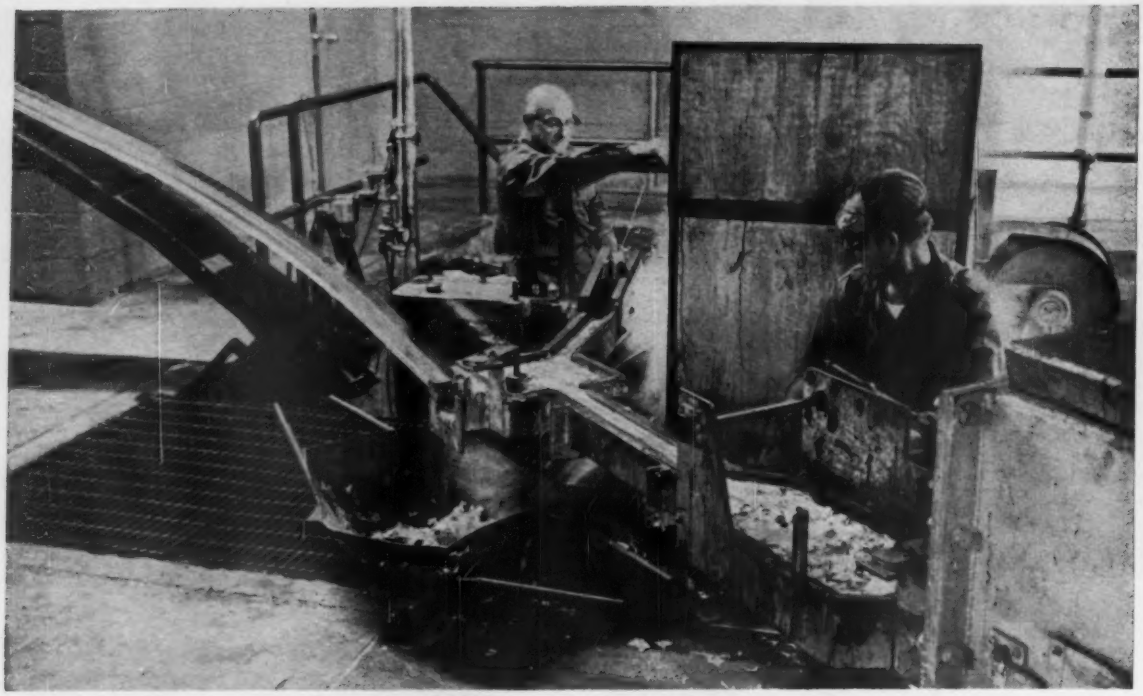


Charging ends of two duplicate hardening, quenching, and drawing lines. Each line, in itself, has duplicate, but separately controlled equipment for maximum flexibility in processing various size races at different feed rates and time cycles

Quality control checks

Because the furnaces are automatic, both in operation and control, the furnace operator can perform other duties relating to the heat-treating operation. In addition to bringing the work to and from the furnaces, he checks the dewpoint of the atmosphere, checks the rate of feed to the hardening furnace, and also takes samples of the work at various points in the lines and checks them for hardness and microstructure.

So that we can move these heat-treating lines as units, should the need arise, all the components of the lines are built on skids. In addition, all furnace roofs are removable to provide for easy inspection and maintenance. •



Molten aluminum pours through feed trough onto rim of casting wheel. Endless steel belt (right rear) forms cover for channel in rim. Continuous-cast strip emerges (left) from lower part of wheel

750,000 aluminum tubes a day!

By Charles Stiassni, vice president
White Metal Mfg Co, Hawthorne, NJ

Three-quarters of a million a day is a lot of anything—especially when the product is collapsible aluminum tubes that start as virgin aluminum ingot and end up painted, printed, plastic-capped, and loaded into compartmented cartons ready for filling.

The process, as carried out at White Metal Manufacturing Co, Hawthorne, NJ, starts at a 7000-lb-capacity, gas-fired furnace, from which molten aluminum flows through an adjustable gate into a receiving basin.

The metal then passes through a manually regulated gate, spilling onto the rim of a 40-inch-diameter, 10-inch-wide casting wheel. Around the rim is a channel 8 inches wide and ¾ inch deep. An endless steel belt, 10 inches wide, contacts the rim of the wheel at a point about 20° below top center, and remains in contact with the wheel rim to about 30° beyond bottom center. This forms a closed trough in which the aluminum solidifies as the wheel rotates at about 13 fpm.

Cold water is sprayed against the wheel flange, and the belt passes through a tank of cooling water after it breaks contact with the wheel, emerging just before it makes contact again.

Reduction rolls

The solidified aluminum leaves the wheel as a continuous strip, passing immediately to a pair of reduction rolls, where thickness is reduced as much as 50% with no change in width. Emerging from the rolls, the strip passes along a roller conveyor and into a second pair of rolls for reduction to final thickness.

As the strip 'eaves the rolls, it passes to one of a pair of coilers placed in tandem. When a coil is full (approximately 1000 lb) its OD contacts a limit switch which transmits a signal to the first pair of rolls, where a flying shear cuts the strip on the exit side.

As soon as the cut clears the second rolls, a roller guide is depressed, causing the next section of strip to head downward after leaving the second rolls and to be picked up by the second coiler.

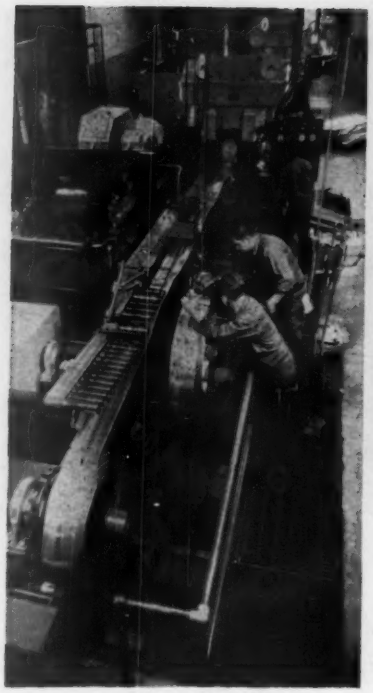
Meanwhile, the first coiler is pulled sideways by a hydraulic cylinder to a point where an operator can secure the free end with steel strapping. A coil hook is inserted and the coiler returns to operating position. The coil is then raised and placed in a storage rack.

Continuous operation planned

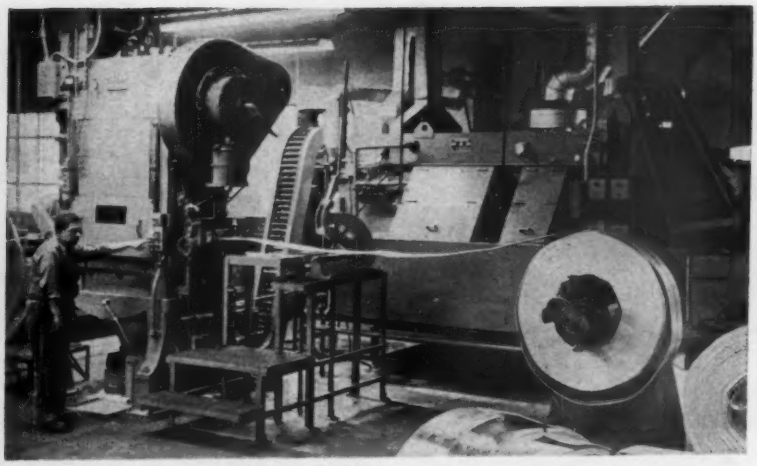
With the present setup, casting stops when the furnace is empty, but provision has been made for installation of a second furnace that can be cut in when the first is empty, thus making the operation continuous. When this is done, automatic controls will also be installed to regulate the flow of metal to the casting wheel.

(This section of the plant was designed in cooperation with Aluminum Ltd of Canada—the principal supplier of primary ingot—which in turn employed the facilities of its Canadian and British research laboratories.)

From the rack, coils are delivered to the slug press, a 100-ton Bliss



Cast strip passes through two sets of reduction rolls to one of two tandem coilers. Speed of rolls governs speed of casting wheel. 1000-lb coil is removed from rear coiler as front one continues to wind



Automatic press blanks and pierces strip, operates at 100 to 200 strokes per min, depending on slug size. Scrap is re-coiled and returned to furnace for remelting, along with virgin ingot 99.9% pure

equipped with hitch feed and scrap coiler and which operates at between 100-200 strokes per minute. The die-set has multiple punches, the number depending upon the size of slug required. The slug, in turn, governs the size of the tube, which may vary from a capacity of a fraction of an ounce for costly pharmaceuticals, to several pounds for caulking compound and similar materials.

Slugs are separated from punchings and fall onto a conveyor which discharges them to a short endless belt mounted on a pivot. This distributes the slugs evenly over a metal mesh belt that carries them through a washing machine and an annealing oven and, finally, to a cooling conveyor where cool air is blown over them.

At the end of this conveyor, slugs are dumped into tote boxes for delivery to the extrusion department, or into cartons for shipment to the company's other extrusion plants.

In the extrusion department, slugs are tumbled for lubrication, then dumped into the hoppers of the horizontal extrusion machines. Slugs are oriented and fed down a chute into the die where they are struck by the extrusion punch. As the punch retracts, the extruded tube is stripped off and falls onto a belt conveyor that carries it to the trimming machine. This has a six-position turret indexing in a vertical plane and carries six pins slightly smaller in diameter than the ID of the tube.

As a pin comes in line with a tube on the conveyor, a mechanical arm pushes the tube onto the pin, which then indexes in front of a single-point tool, trimming off the excess metal at the nozzle end.

At the next index, the nozzle is threaded by a pair of threading rolls. Then a rotary knife trims the large end to length and, finally, a single-point tool re-trims the nozzle.

At the last station, a mechanical pusher strips the tube off the pin and onto a conveyor, which carries it through an annealing furnace.

All scrap is collected

Up to this point, all scrap (whether from the rolls, slug press, extrusion press, or trimming machine) is collected and charged back into the furnace for remelt. Painted scrap, however, is baled and sold for recovery as secondary aluminum.

Annealed tubes are discharged to a cleated conveyor, from which they are mechanically pushed onto the mandrels of a coating machine. These carry the tube past the face of a rotating roller, which applies the base coat of paint. Tubes are then stripped off onto a transfer turret, from which they are conveyed to a continuous chain conveyor that carries them through a baking oven.

Returning from the oven, tubes are transferred to a printing machine, where lettering is applied by offset printing in as many as four colors. They are again transferred to a continuous chain conveyor and passed through the oven.

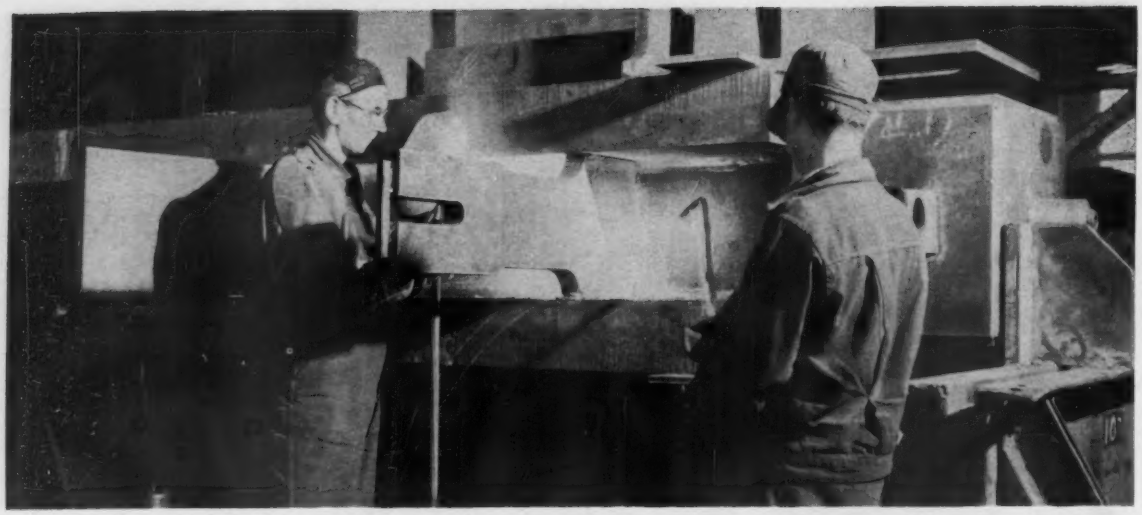
Finished tubes are discharged, head to tail, on a narrow belt conveyor, and into a chute, so as to pass in front of a capping head. Plastic caps are fed from a hopper into a chute, dropping into a rotating head which screws them firmly on to the nozzle end of the tube.

Packed for delivery

Capped tubes are conveyed to an operator, who picks up three or four at a time, inspects them, and drops them (open end up) into compartmented cartons for delivery to the customer. This is the only time the tubes are touched by hand, and the operation could readily be mechanized, were it not for the need for visual inspection for dents and paint defects.

The plant operates three shifts a day, with a work force of about 50 operators per shift, and it is believed to be the only one of its kind in the country.

In addition to producing collapsible tubes, White Metal also turns out large quantities of extruded "cans" for condensers and other electronic equipment. The procedure is similar to that described above except that slugs are not pierced, and extrusion is done on a conventional vertical press. No painting is required, and the only additional operation is trimming the open end. •



One operator welds connecting member to heavy H-beam while other man maintains preheat temperature with oxy-acetylene torch. Columns were part of largest structural-steel job produced to date by Dominion Bridge Co

Giant columns are shop welded

The trend in building is toward welding, and this means more and more shop welding, too, instead of riveting. Here's how the massive structural members were shop-prefabricated for Montreal's 32-story C-I-L House

By G F W Barrett,
Dominion Bridge Co Ltd,
Montreal, Canada

Welded prefabrication of heavy structural shapes is growing in importance for at least two reasons: 1) welding is gaining greater acceptance in the building industry, and 2) the architect wants special, extra-heavy shapes to execute his designs for modern structures.

A good example of the shapes produced by this technique is the steelwork for the new, 32-story C-I-L House in Montreal, recently fabricated and erected by Dominion Bridge Co. This building, 430 ft high, is the tallest welded, rigid-framed structure in Canada, and it has the heaviest solid H-section columns ever constructed there.

Some of the columns, which were made of heavy steel slabs welded together, weigh as much as 2000 lb per lineal ft. For a comparison, the heaviest columns listed in the steel companies' shape books weigh 426 lb per lineal ft.

Furthermore, the length of the columns varies from 22 ft to 34 ft, 3½ in., each column being two stories high. Cross section of the flanges runs up to 7¼ x 28 in., and the webs range up to 6 x 16½ in.

With plates as thick as this, welding problems can become acute, especially the problem of cracking. In addition, the materials for the job were ASTM A-373 and A-284, which can have a carbon content as high as 0.35%. Steel with this much carbon is very difficult to weld without cracking.

All plates were preheated

Therefore, all plates were preheated before welding—at a preheat temperature that depended on carbon content and thickness involved. These ranged from 200 F for lighter plates and low carbon content to 400 F for the heavier plates and higher carbon content. (In actual fact, none of the plates delivered contained more than 0.28% carbon.)

Each plate was color coded in the initial stages of fabrication to tell the operator what welding procedure he should employ, and the procedure included the appropriate preheat temperature.

The fabrication sequence went as follows:

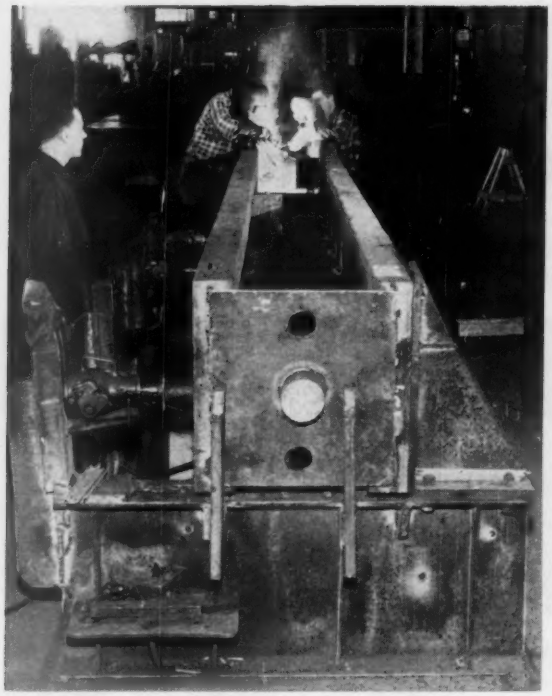
1) Web plates, ordered double width, were flame cut to a dimension slightly wider than the required finished size.

2) Where distortion occurred during cutting, the plates were straightened (edgewise) on a 2500-ton forming press.

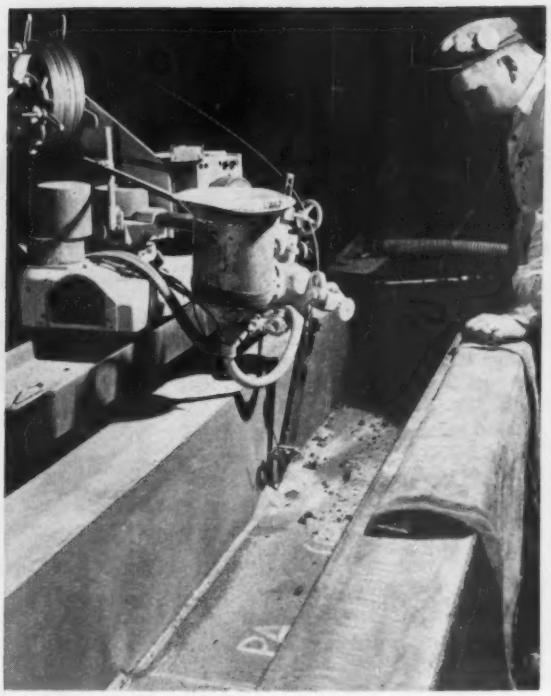
3) All web plates over 2½ in. thick were then machined to the required dimension on both edges on a plano-milling machine. This removed any material that might have been adversely affected by the burning operation. It also trued-up the edges and made final assembly much simpler and more accurate. Plates under 2½ in. were not machined, because they could be burned sufficiently square and accurate.

4) Flange material was, for the most part, ordered to size from the mills as rolled-edge plates and required no trimming. Some flame-straightening was necessary, however, as the side camber in some of them was greater than that permitted in a column.

For flame straightening, heat was applied locally to the convex side of the warped plate until it turned



Tack-weld fixture holds plates together with jacks. Temporary end plate has trunnion for rotating work in later operations



Submerged arc makes deep-penetration weld in prepared groove; remainder of column is fillet welded

bright red. This caused a certain amount of local upsetting and thickening. Then, when the material was allowed to cool rapidly, the convex side contracted to a shorter length than it had before.

5) At locations where loads would be transmitted into the columns from the floor beams of the building. the webs of the columns were grooved with oxyacetylene torches to permit high-strength welds. Depth and length of the groove welds depended on the loads being transmitted, but in many cases they were full-penetration welds several feet long.

Between these locations, only fillet welds were required, so no edge preparation was necessary. On the average, about 25% of the column length was groove welded, the balance fillet welded.

6) All surfaces to be welded were cleaned of scale and rust either by shot blasting or grinding.

The welding operations

7) Then the webs and flanges were assembled and tack welded in a jig, where 35-ton jacks forced the plates together. End plates were also welded to the columns to act as supports during the welding operations and to restrain any distortion.

8) After tacking, the column was placed over a natural-gas heating unit for preheating to the desired temperature. Then the V-bottom of the grooves was rounded out to a J-contour with an Arcair torch.

Wherever there was a gap of 1/16 in. or more between the web and the flange at the root of the groove, a weld bead was placed manually in order to avoid burn-through during automatic welding.

9) The column was then transferred to one of two submerged-arc setups where it was mounted on trunnions so it could be rotated with the help of a small hoist. Here the grooves were filled flush with the web surface. Preheat was maintained with natural-gas burners at all times during this operation and the succeeding fillet-welding operation.

10) Next, the fillets were made using two welding machines and multiple passes to complete the required size.

11) The end plates were then removed from the column and the ends faced to required length on high-speed milling machines.

12) When the columns returned to the fabrication shop, the detail parts for floor-beam and splice connections were located and tack welded in place. All such connecting material was completely shop welded. At the same time temporary stiffeners were also tacked to the assembly to minimize distortion.

All joints were then torch-preheated before being manually welded with iron-powder, low-hydrogen electrodes. Preheat (checked with temperature-indicating crayons) was held through the operation.

Accurate dimensions held

In order to facilitate field erection and welding, dimensions had to be held closely during shop welding. The distance between splice plates at the ends of columns, for example, was maintained by adding shims when necessary to the outside faces of column flanges. (Flange thickness could vary by 7/32 in. and still meet mill tolerances.)

Flange thickness also influenced the location of bolt holes for field erection, so many of these holes were drilled in connecting members after they were welded to the column instead of before. Field bolting, by the way, did not hold the building together; it only held the members in place until they could be welded to the structure.

After being welded, the column sections were inspected dimensionally. Final quality control also included a magnetic-particle (Magnaflux) survey of all welds for gross defects and surface cracks. •

For depths to 27 or more diameters

Rotary table aids deep drilling

By John Dow, superintendent of manufacturing,
Aeronautical Division, Minneapolis-Honeywell Regulator Co, Minneapolis

Drilling small holes to depths exceeding two or three diameters is a much simpler job if both the workpiece and the drill can be rotated. This is easy to do on lathes and screw machines (where the tool can be mounted on a drill speeder) but it is not so easy on a drillpress.

For example, in drilling small, deep holes in aluminum bodies for hydraulic valves used in aeronautical control systems, Minneapolis-Honeywell ran into trouble with "wandering" drills.

Lathe setups didn't work

To remedy this, we tried lathe setups, but hit another snag in trying to balance the workholding fixtures mounted on the faceplates. And available lathes were needed for other operations.

Troubles disappeared when the faceplate fixtures were mounted on Vulcan rotary tables driven by air turbines. These setups were placed on the tables of Delta bench-type drillpresses, equipped with Bellows air-hydraulic spindle feed units and Sensitorque drill return controls.

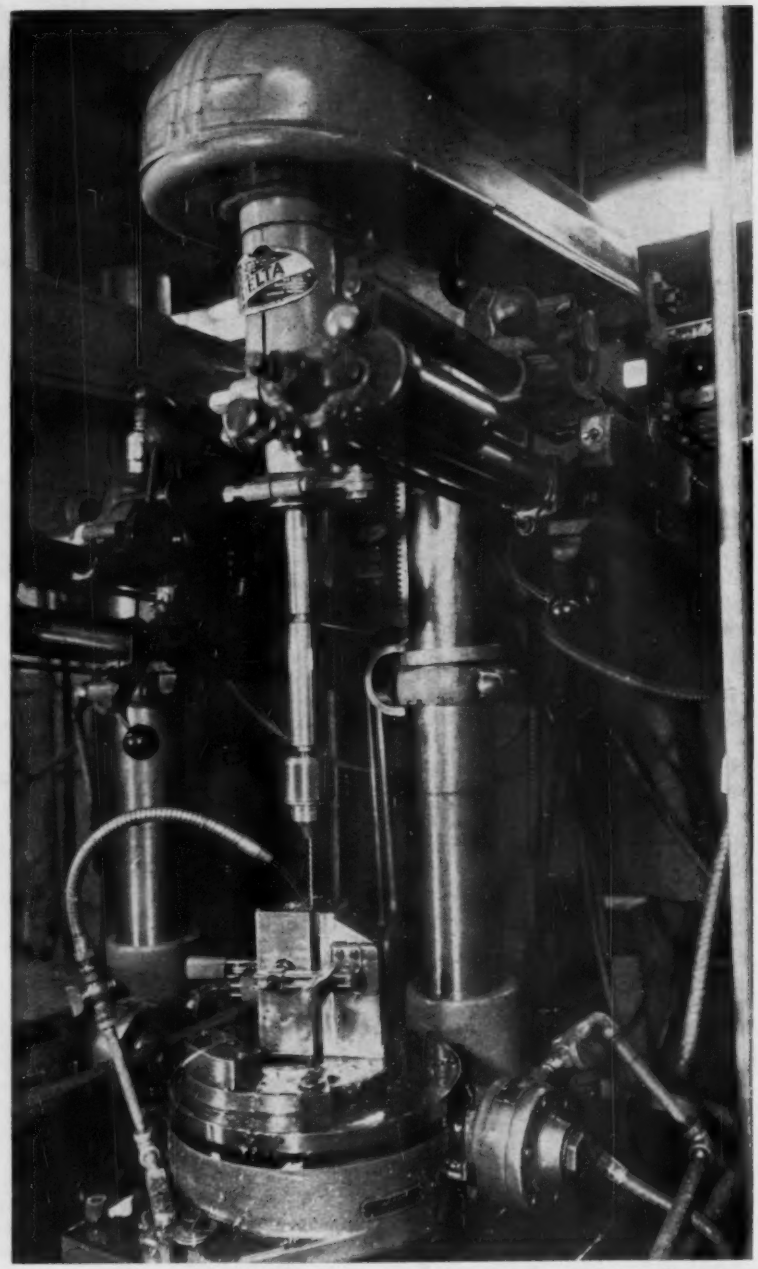
Drilling 27 diameters deep

In the setup shown in the photograph, a 0.120-in.-diameter hole is being drilled to a depth of 3.29 in. (27 diameters) to intersect a hole of the same diameter drilled through the side of the 45S-T6 aluminum alloy hydraulic ram body.

An extra-long, high-helix drill with a 110-degree point is used at 4250 rpm; spindle speed is set at 6 ipm. The Sensitorque unit is set to retract the drill and clear the chips before they pack in the flutes and score the hole.

Best results at 60 rpm

Best results are achieved by turning the Vulcan rotary table at 60 rpm during drilling. After each drilling operation is completed, the intersecting holes are reamed to 0.1250-0.1255 in. diameter in the same rotary table setup. Burrs left at the intersection of the holes are removed by passing a 0.120-in.-diameter helical steel wire brush through the holes. The wire is held in a pin vise and hand rotated. •



Light mineral-seal cutting oil is flooded over the top of the workpiece throughout drilling and reaming operations. Straightness and accuracy of holes is controlled by air-powered rotary table and torque-limiting feed

American Machinist / Metalworking Manufacturing

Standard designations for wrought copper metals

To end confusion in identification of copper metals, the Copper & Brass Research Association has adopted a 3-digit numbering system for commercially important wrought coppers and copper alloys. For example, Copper Alloy 260 is now the designation for 70% cartridge brass, for which specifications had previously been written by no fewer than 22 government agencies and outside associations.

These 3-digit numbers are in time expected to replace trade designations like Rich Low Brass, Spring Brass, Commercial Bronze, Muntz Metal, Naval Brass, and such oddities as Talmi Gold and Tournay's Metal. Too often, these trade designations are erroneous. Commercial Bronze, for example, is bronze in color but is actually a brass; Nickel Silver is silvery in appearance but contains no silver.

For a time, the previously accepted trade designation will be associated with the 3-digit identifying number. Eventually, trade designations will disappear and tradenames probably will too. The concise numerical designation can be checked quickly for chemical composition. Thus, a purchasing agent, designer, stock-room clerk can know promptly whether he is dealing with a pure copper, a non-leaded copper-zinc alloy (formerly called non-leaded brass) or a copper-aluminum alloy (formerly called aluminum bronze). Information on physical and mechanical properties, dimensions and shapes for a particular copper alloy will continue to be found in CABRA's Manual of Standards, if a standard alloy is involved, or from the data of suppliers if the material is a special one.

Tabulated entries printed in bold-face type represent coppers or copper alloys considered standard throughout the copper industry, and light-face entries indicate materials that are not made by all companies. For further convenience of the user, the coppers and copper alloys have been broken in 18 groups by *AM/MM* editors, according to basic analysis.

	COPPER NUMBER	PREVIOUS TRADE DESIGNATION	Copper plus Silver (% min.)	COMPOSITION, PER CENT MAXIMUM (Unless shown as a range or minimum) Silver (oz./ton)	Arsenic	Antimony	Phosphorus	Tellurium	Nickel	Bismuth	Lead	Other named elements	Total other elements A
Coppers Cu+Ag, 99.88% min.	**101** B	**Oxygen Free Certified**	**99.96**	—	—	—	—	—	—	—	—	—	—
	102 B	**Oxygen Free**	**99.95**	—	—	—	—	—	—	—	—	—	—
	104 B	Oxygen Free with Silver	99.95	8 (min)	—	—	—	—	—	—	—	—	—
	105 B	Oxygen Free with Silver	99.95	10 (min)	—	—	—	—	—	—	—	—	—
	110 B	**Electrolytic Tough Pitch**	**99.90**	—	—	—	—	—	—	—	—	—	—
	111 B	Electrolytic Tough Pitch Anneal Resist.	99.90	—	—	—	—	—	—	—	—	—	C
	113 B D	Tough Pitch with Silver	99.90	8 (min)	—	—	—	—	—	—	—	—	—
	114 B D	Tough Pitch with Silver	99.90	10 (min)	—	—	—	—	—	—	—	—	—
	116 B D	Tough Pitch with Silver	99.90	25 (min)	—	—	—	—	—	—	—	—	—
	120	Phosphorus Deoxidized Low Residual Phosphorus	99.90	—	—	—	.004–.012	—	—	—	—	—	—
	121		99.90	4 (min)	—	—	.005–.012	—	—	—	—	—	—
	122 E	**Phosphorus Deoxidized High Residual Phosphorus**	99.90	—	—	—	.015–.040	—	—	—	—	—	—
	123		99.90	4 (min)	—	—	.015–.025	—	—	—	—	—	—
	125 F	Fire Refined Tough Pitch	99.88	—	.012	.003	—	.025 G	.05	.003	.004	—	—
	127 F	Fire Refined Tough Pitch with Silver	99.88	8 (min)	.012	.003	—	.025 G	.05	.003	.004	—	—
	128 F	Fire Refined Tough Pitch with Silver	99.88	10 (min)	.012	.003	—	.025 G	.05	.003	.004	—	—
	130 F	Fire Refined Tough Pitch with Silver	99.88	25 (min)	.012	.003	—	.025 G	.05	.003	.004	—	—
Modified Coppers Cu+Ag, 99.30% min.	141	Arsenical Tough Pitch	99.40	—	.15–.50	—	—	—	—	—	—	—	—
	142	Phosphorus Deoxidized Arsenical	99.40	—	.15–.50	—	.015–.040	—	—	—	—	—	—
	145 H	Phosphorus Deoxidized Tellurium Bearing	99.90 I	—	—	—	.004–.012	.40–.60	—	—	—	—	—
	147	Sulfur Bearing	99.90 J	—	—	—	—	—	—	—	—	.2–.5 Sulfur	—
	150	Zirconium Copper	99.80	—	—	—	—	—	—	—	—	.10–.15 Zirc.	—

Special Copper Alloys

COPPER ALLOY NUMBER	PREVIOUS TRADE DESIGNATION	Copper+Silver+elements with specific limits (% min.)	Iron	Tin	Nickel	Cobalt	Chromium	Silicon	Beryllium	Lead	Cadmium	Other named elements	Total other elements A
162	Cadmium Copper	99.75	.02	—	—	—	—	—	—	—	.7–1.2	—	—
164		99.75	.02	.2–.4	—	—	—	—	—	—	.6–.9	—	—
165		99.75	.02	.5–.7	—	—	—	—	—	—	.6–1.0	—	—
172	Beryllium Copper	99.5	K	—	K	K	—	—	1.80–2.05	—	—	—	—
182	Chromium Copper	99.5	.10	—	—	—	.6–1.2	.10	—	.05	—	—	—
184	Chromium Copper	99.75	.15	—	—	—	.40–1.20	.10	—	—	—	.005 Arsenic .005 Calcium .05 Lithium .05 Phos. .70 Zinc	.05
185	Chromium Copper	99.75	—	—	—	—	.40–1.00	—	—	.015	—	.04 Phos.	.15
190		99.5	.10	—	.9–1.3	—	—	—	—	.05	—	.08–.12 Silver .75 Zinc	.5
191		99.5	.2	—	.9–1.3	—	—	—	—	.1	—	.15–.35 Phos. .5 Zinc	.5
193		92.0–94.0 Note 1	2.05–2.60	.03	—	—	—	—	—	.03	—	.15–.35 Phos. .35–.65 Tellurium Rem. Zinc .02 Aluminum	.05

Copper—Zinc Alloys

Copper—Zinc—Lead Alloys

COPPER ALLOY NUMBER	PREVIOUS TRADE DESIGNATION	COMPOSITION, PERCENT MAXIMUM (Unless shown as a range or minimum)												Total other elements A
		Copper	Lead	Iron	Tin	Zinc	Nickel	Aluminum	Phosphorus	Arsenic	Antimony	Manganese	Silicon	
210	Gilding, 95%	94.0–96.0	.05	.05	—	Rem.	—	—	—	—	—	—	—	.10
220	Commercial Bronze, 90%	89.0–91.0	.05	.05	—	Rem.	—	—	—	—	—	—	—	.10
226	Jewelry Bronze 87½%	86.0–89.0	.05	.05	—	Rem.	—	—	—	—	—	—	—	.15
230	Red Brass, 85%	84.0–86.0	.05	.05	—	Rem.	—	—	—	—	—	—	—	.15
234		81.0–84.0	.05	.05	—	Rem.	—	—	—	—	—	—	—	.15
240	Low Brass, 80%	78.5–81.5	.05	.05	—	Rem.	—	—	—	—	—	—	—	.15
260	Cartridge Brass, 70%	68.5–71.5	.07	.05	—	Rem.	—	—	—	—	—	—	—	.15
261		68.5–71.5	.05	.05	—	Rem.	—	—	—	—	—	—	—	.15
262		67.0–70.0	.07	.05	—	Rem.	—	—	.02–.05	—	—	—	—	.15
268	Yellow Brass 66% (Sheet)	64.0–68.5	.15	.05	—	Rem.	—	—	—	—	—	—	—	.15
270	Yellow Brass 65% (Rod and Wire)	63.0–68.5	.10	.05	—	Rem.	—	—	—	—	—	—	—	.15
274	Yellow Brass 63%	61.0–64.0	.10	.05	—	Rem.	—	—	—	—	—	—	—	.15
280	Muntz Metal 60%	59.0–63.0	.30	.07	—	Rem.	—	—	—	—	—	—	—	.20
298	Brazing Alloy	49.0–52.0	.50	.10	—	Rem.	—	.10	—	—	—	—	—	.20
310	Leaded Commercial Bronze (Low Lead)	89.0–91.0	.3–.7	.10	—	Rem.	—	—	—	—	—	—	—	—
314	Leaded Commercial Bronze	87.5–90.5	1.3–2.5	.10	—	Rem.	—	—	—	—	—	—	—	.50
316	Leaded Commercial Bronze (Nickel Bearing)	87.5–90.5	1.3–2.5	.10	—	Rem.	.7–1.2	—	—	—	—	—	—	.50
320	Leaded Red Brass	83.5–86.5	1.5–2.2	.10	—	Rem.	—	—	—	—	—	—	—	.50
325		72.0–74.5	2.5–3.0	.10	—	Rem.	—	—	—	—	—	—	—	.50
330	Low Leaded Brass (Tube)	65.0–68.0	.2–.8	.07	—	Rem.	—	—	—	—	—	—	—	.50
331		65.0–68.0	.7–1.2	.06	—	Rem.	—	—	—	—	—	—	—	.50
332	High Leaded Brass (Tube)	65.0–68.0	1.3–2.0	.07	—	Rem.	—	—	—	—	—	—	—	.50
335	Low Leaded Brass	62.5–66.5	.3–.7	.10	—	Rem.	—	—	—	—	—	—	—	.50
340	Medium Leaded Brass 64½%	62.5–66.5	.8–1.4	.10	—	Rem.	—	—	—	—	—	—	—	.50
342	High Leaded Brass 64½%	62.5–66.5	1.5–2.5	.10	—	Rem.	—	—	—	—	—	—	—	.50
344		62.0–66.0	.5–1.0	.10	—	Rem.	—	—	—	—	—	—	—	.50
347		62.5–64.5	1.0–1.8	.10	—	Rem.	—	—	—	—	—	—	—	.50
348		61.5–63.5	.4–.8	.10	—	Rem.	—	—	—	—	—	—	—	.50
350	Medium Leaded Brass 62%	61.0–64.0	.8–1.4	.10	—	Rem.	—	—	—	—	—	—	—	.50
353	High Leaded Brass 62%	59.0–64.5	1.3–2.3	.10	—	Rem.	—	—	—	—	—	—	—	.50
356	Extra High Leaded Brass	60.0–64.5	2.0–3.0	.10	—	Rem.	—	—	—	—	—	—	—	.50
360	Free Cutting Brass	60.0–63.0	2.5–3.7	.35	—	Rem.	—	—	—	—	—	—	—	.50
362		60.0–63.0	3.5–4.5	.15	—	Rem.	—	—	—	—	—	—	—	.50
365	Leaded Muntz Metal, Uninhibited	58.0–61.0	.4–.9	.15	.25	Rem.	—	—	—	—	—	—	—	.50
366	Leaded Muntz Metal, Arsenical	58.0–61.0	.4–.9	.15	.25	Rem.	—	—	—	—	—	—	—	.10
367	Leaded Muntz Metal, Antimonial	58.0–61.0	.4–.9	.15	.25	Rem.	—	—	—	.02–.10	—	—	—	.10
368	Leaded Muntz Metal, Phosphorized	58.0–61.0	.4–.9	.15	.25	Rem.	—	—	—	—	.02–.10	—	—	.10
370	Free Cutting Muntz Metal	59.0–62.0	.9–1.4	.15	—	Rem.	—	—	.02–.10	—	—	—	—	.10
371		58.0–62.0	.6–1.2	.15	—	Rem.	—	—	—	—	—	—	—	.50
377	Forging Brass	58.0–62.0	1.5–2.5	.30	—	Rem.	—	—	—	—	—	—	—	.50
385	Architectural Bronze	55.0–60.0	2.0–3.8	.35	—	Rem.	—	—	—	—	—	—	—	.50

Bold Face capital letters after Copper number or element of composition are keyed to footnotes on reverse side.

Standard designations for wrought copper metals (continued)

	COPPER ALLOY NUMBER	PREVIOUS TRADE DESIGNATION	COMPOSITION, PERCENT MAXIMUM (Unless shown as a range or minimum)													
			Copper	Lead	Iron	Tin	Zinc	Nickel	Aluminum	Phosphorus	Arsenic	Antimony	Manganese	Silicon	Total other elements A
Copper—Zinc—Tin Alloys	405		94.0–96.0	.05	.05	.7–1.3	Rem.	—	—	—	—	—	—	—	.15
	408		94.0–96.0	.05	.05	1.8–2.2	Rem.	—	—	—	—	—	—	—	.15
	410		91.0–93.0	.05	.05	2.0–2.8	Rem.	—	—	—	—	—	—	—	.15
	411		89.0–92.0	.10	.05	.3–.7	Rem.	—	—	—	—	—	—	—	.15
	413		89.0–93.0	.10	.05	.7–1.3	Rem.	—	—	—	—	—	—	—	.15
	415		89.0–93.0	.10	.05	1.5–2.2	Rem.	—	—	—	—	—	—	—	.15
	419		89.0–92.0	.10	.05	4.8–5.5	Rem.	—	—	—	—	—	—	—	.15
	420		88.0–91.0	—	—	1.5–2.0	Rem.	—	—	.25	—	—	—	—	.15
	422		86.0–89.0	.05	.05	.8–1.4	Rem.	—	—	—	—	—	—	—	.15
	425		87.0–90.0	.05	.05	1.5–2.2	Rem.	—	—	—	—	—	—	—	.15
	430		85.0–89.0	.10	.05	1.7–2.7	Rem.	—	—	—	—	—	—	—	.15
	432		85.0–87.0	.05	.05	.4–.6	Rem.	—	—	—	—	—	—	—	.15
	434		84.0–86.0	.05	.05	.5–1.0	Rem.	—	—	—	—	—	—	—	.15
	435		79.0–83.0	.10	.05	.6–1.2	Rem.	—	—	—	—	—	—	—	.15
	438		79.0–82.0	.05	.05	1.0–1.5	Rem.	—	—	—	—	—	—	—	.15
	442	Admiralty Uninhibited	70.0–73.0	.07	.05	.8–1.2	Rem.	—	—	—	—	—	—	—	.15
	443	Admiralty Arsenical	70.0–73.0	.07	.06	.8–1.2	Rem.	—	—	—	.02–.10	—	—	—	.10
	444	Admiralty Antimonial	70.0–73.0	.07	.06	.8–1.2	Rem.	—	—	—	—	.02–.10	—	—	.10
	445	Admiralty Phosphorized	70.0–73.0	.07	.06	.8–1.2	Rem.	—	—	.02–.10	—	—	—	—	.10
	462	Naval Brass 63½%	62.0–65.0	.20	.10	.5–.10	Rem.	—	—	—	—	—	—	—	.10
	464	Naval Brass	59.0–62.0	.20	.10	.5–1.0	Rem.	—	—	—	—	—	—	—	.10
	465	Naval Brass Arsenical	59.0–62.0	.20	.10	.5–1.0	Rem.	—	—	—	.02–.10	—	—	—	.10
	466	Naval Brass Antimonial	59.0–62.0	.20	.10	.5–1.0	Rem.	—	—	—	—	.02–.10	—	—	.10
	467	Naval Brass Phosphorized	59.0–62.0	.20	.10	.5–1.0	Rem.	—	—	.02–.10	—	—	—	—	.10
	470	Naval Brass Welding & Brazing Rod	57.0–61.0	.05	—	.25–1.0	Rem.	—	.01	—	—	—	—	—	.50 L
	472	Brazing Alloy	49.0–52.0	.50	.10	3.0–4.0	Rem.	—	—	—	—	—	—	—	—
Copper—Zinc—Tin—Lead Alloys	482	Naval Brass Medium Leaded	59.0–62.0	.4–1.0	.10	.5–1.0	Rem.	—	—	—	—	—	—	—	.10
	486	Naval Brass High Leaded	59.0–62.0	1.3–2.2	.10	.5–1.0	Rem.	—	—	—	—	—	—	—	.10
Copper—Tin Alloys			Note 2												
	502	Phosphor Bronze E	99.5	.05	.10	1.0–1.5	—	—	—	.04	—	—	—	—	—
	505		99.5	.05	.10	1.0–1.7	.30	—	—	.03–.35	—	—	—	—	—
	507		99.5	.05	.10	1.5–2.0	—	—	—	.04	—	—	—	—	—
	508		99.5	.05	.10	2.6–3.4	—	—	—	.01–.07	—	—	—	—	—
	509		99.5	.05	.10	2.5–3.8	—	—	—	.15–.30	—	—	—	—	—
	510	Phosphor Bronze A	99.5	.05	.10	3.5–5.8	.30	—	—	.03–.35	—	—	—	—	—
	518	Phosphor Bronze	99.5	.02	—	4.0–6.0	—	—	—	.10–.35	—	—	—	—	—
	521	Phosphor Bronze C	99.5	.05	.10	7.0–9.0	.20	—	—	.03–.35	—	—	—	—	—
	524	Phosphor Bronze D	99.5	.05	.10	9.0–11.0	.20	—	—	.03–.35	—	—	—	—	—
Copper—Tin—Lead Alloys			Note 3												
	532	Phosphor Bronze B	99.5	2.5–4.0	.10	4.0–5.5	.20	—	—	.03–.35	—	—	—	—	—
	534	Phosphor Bronze B-1	99.5	.8–1.2	.10	3.5–5.8	.30	—	—	.03–.35	—	—	—	—	—
	544	Phosphor Bronze B-2	99.5 M	3.5–4.5	.10	3.5–4.5	1.5–4.5	—	—	.01–.50	—	—	—	—	—
	546	Phosphor Bronze B-2 (P 0.50 max.)	99.5 M	3.5–4.5	.10	3.5–4.5	1.5–4.5	—	—	.50	—	—	—	—	—
Copper—Aluminum Alloys			Note 4												
	606		99.5	—	.50	—	—	—	4.0–7.0	—	—	—	—	—	—
	608		99.5	.10	.10	—	—	—	5.0–6.5	—	.35	—	—	—	—
	610		99.5	.02	—	—	.20	—	6.0–9.0	—	—	—	—	.10	—
	612		99.5	—	.50	—	—	—	7.0–9.0	—	—	—	—	—	—
	614	Aluminum Bronze D	99.5	—	1.5–3.5	—	—	—	6.0–8.0	—	—	—	1.0	—	—
	616		99.5	—	4.0	.6	1.0	1.0	6.5–11.0	—	—	—	1.5	.25	—
	618		99.5	.02	1.5	—	.02	—	9.0–11.0	—	—	—	—	.10	—
	620		99.5	—	3.2–3.7	—	—	—	9.8–10.5	—	—	—	—	—	—
	622		99.5	.02	3.0–4.25	—	.02	—	11.0–12.0	—	—	—	—	.10	—
	624		99.5	—	2.0–4.0	.20	—	—	9.0–11.0	—	—	—	.30	—	—
	626		99.7	—	2.0–4.5	—	—	3.0–4.5	9.7–10.7	—	—	—	1.5	—	—
	628		99.5	—	1.5–3.5	—	—	4.0–7.0	8.0–11.0	—	—	—	.5–2.0	—	—
	630		99.5	—	2.0–4.0	.20	—	4.0–5.5	9.0–11.0	—	—	—	1.5	.25	—
Copper—Aluminum—Silicon Alloys	637		99.5	.05	.3	.6	1.0	.25	6.5–8.5	—	—	—	—	1.2–2.2	—
	639		99.5	.05	.10	—	—	—	6.5–8.0	—	—	—	—	1.5–3.0	—
	642		99.5	—	4.0	.6	1.0	.25	6.5–11.0	—	—	—	1.5	2.2	—
	647		99.5	.1	.1	—	.5	1.6–2.2	—	—	—	—	—	.4–.8	—
	651	Low Silicon Bronze B	99.5	.05	.8	—	1.5	—	—	—	—	—	.7	1.5–2.0	—

Copper—Silicon Alloys	647		99.5	.1	.1	—	.5	1.6–2.2	—	—	—	—	—	.6–.8	—
	651	Low Silicon Bronze B	99.5	.05	.8	—	1.5	—	—	—	—	—	.7	.8–2.0	—
	653		99.7	.05	.8	—	—	—	—	—	—	—	—	.8–2.0	—
	655	High Silicon Bronze A	99.5	.05	1.6	—	1.5	.6	—	—	—	—	—	2.0–2.6	—
	656		99.5	.02	.5	1.5	1.5	—	.01	—	—	—	1.5	2.8–3.5	—
	658		99.5	.05	.5	—	—	—	.01	—	—	—	1.5	2.8–4.0	—
	661		99.5	.2–.8	.25	—	1.5	—	—	—	—	—	1.3	2.8–3.8	—
													1.5	2.8–3.5	—
Copper—Zinc—Manganese Alloys	665		80.0–82.0	0.5	.10	—	Rem.	—	—	—	—	—	.7–1.5	—	.15
	667	Manganese Brass	68.5–71.5	.07	.10	—	Rem.	—	—	—	—	—	.8–1.5	—	.50
	670	Manganese Bronze B	63.0–68.0	.20	2.0–4.0	.50	Rem.	—	3.0–6.0	—	—	—	2.5–5.0	—	.20
	675	Manganese Bronze A	57.0–60.0	.20	.80–2.0	.5–1.5	Rem.	—	.25	—	—	—	.05–.5	—	.10
	680	Bronze, Low Fuming (Nickel)	56.0–60.0	.05	.25–1.25	.75–1.10	Rem.	.2–.8	.01	—	—	—	.01–.50	.04–.15	.50 L
	681	Bronze, Low Fuming	56.0–60.0	.05	.25–1.25	.75–1.10	Rem.	—	.01	—	—	—	.04–.15	.04–.15	.50 L
Copper—Zinc—Aluminum Alloys	685		85.0–89.0	.05	1.5–2.5	.10	Rem.	—	3.5–4.5	—	—	—	—	—	.10
	687	Aluminum Brass Arsenical	76.0–79.0	.07	.06	—	Rem.	—	1.8–2.5	—	.02–.10	—	—	—	.10
Copper—Zinc—Silicon Alloys	692	Silicon Brass	89.0–91.0	.05	.05	—	Rem.	—	—	—	—	—	—	.8–1.5	.50
	694	Silicon Red Brass	80.0–83.0	.20	.10	—	Rem.	—	—	—	—	—	—	3.5–4.5	.50
	697		75.0–80.0	.5–1.5	.10	—	Rem.	—	—	—	—	—	.40	2.5–3.5	.50
Copper—Nickel Alloys	702		99.7	.05	.10	—	—	2.0–3.0	—	—	—	—	.40	—	—
	703		99.5	—	.05	—	—	4.7–5.7	—	—	—	—	.5	—	—
	704	Copper Nickel 5%	99.6	.05	1.3–1.7	—	—	4.75–6.25	—	—	—	—	.30–.80	—	—
	705	Copper Nickel 7%	99.5	.05	.10	—	.20	6.0–8.0	—	—	—	—	.15	—	—
	706	Copper Nickel 10%	99.5	.05	.5–2.0	—	1.0	9.0–11.0	—	—	—	—	1.0	—	—
	707		99.5	—	.05	—	—	9.5–10.5	—	—	—	—	.5	—	—
	708	Copper Nickel 11%	99.5	.05	.10	—	.20	10.5–12.5	—	—	—	—	.15	—	—
	710	Copper Nickel 20%	99.5	.05	1.0	—	1.0	19.0–23.0	—	—	—	—	1.0	—	—
	715	Copper Nickel 30%	99.5	.05	.40–.70	—	1.0	29.0–33.0	—	—	—	—	1.0	—	—
	720	Copper Nickel 40%	99.5	.05	1.5–2.5	—	.3	40.0–43.0	—	—	—	—	.8–1.7	—	—
Copper—Nickel—Zinc Alloys	732		70.0 (min)	.05	.6	—	3.0–6.0	19.0–23.0	—	—	—	—	1.0	—	—
	735		70.5–73.5	.10	.25	—	Rem.	16.5–19.5	—	—	—	—	.50	—	.50
	740		69.0–73.5	.10	.25	—	Rem.	9.0–11.0	—	—	—	—	.50	—	.50
	745	Nickel Silver 65-10	63.5–68.5	.10	.25	—	Rem.	9.0–11.0	—	—	—	—	.50	—	.50
	752	Nickel Silver 65-18	63.0–66.5	.10	.25	—	Rem.	16.5–19.5	—	—	—	—	.50	—	.50
	754	Nickel Silver 65-15	63.5–66.5	.10	.25	—	Rem.	14.0–16.0	—	—	—	—	.50	—	.50
	757	Nickel Silver 65-12	63.5–66.5	.05	.25	—	Rem.	11.0–13.0	—	—	—	—	.50	—	.50
	762		57.0–61.0	.10	.25	—	Rem.	11.0–13.5	—	—	—	—	.50	—	.50
	764		58.5–61.5	.05	.25	—	Rem.	16.5–19.5	—	—	—	—	.50	—	.10
	766		55.0–58.0	.10	.25	—	Rem.	11.0–13.5	—	—	—	—	.50	—	.50
	770	Nickel Silver 55-18	53.5–56.5	.10	.25	—	Rem.	16.5–19.5	—	—	—	—	.50	—	.50
	773		46.0–50.0	.05	—	—	Rem.	9.0–11.0	—	.25	—	—	—	.04–.25	—
	774		43.0–47.0	.20	—	—	Rem.	9.0–11.0	—	—	—	—	—	—	.50
Copper—Nickel—Zinc—Lead Alloys	782		63.0–67.0	1.50–2.25	.35	—	Rem.	7.0–9.0	—	—	—	—	.50	—	.10
	784		60.0–63.0	.8–1.4	.25	—	Rem.	9.0–11.0	—	—	—	—	.50	—	—
	786		60.0–63.0	1.25–1.75	.35	—	Rem.	8.5–11.0	—	—	—	—	.50	—	.10
	788		63.0–67.0	1.5–2.0	.25	—	Rem.	9.0–11.0	—	—	—	—	.50	—	—
	790		63.0–67.0	1.50–2.25	.35	—	Rem.	11.0–13.0	—	—	—	—	.50	—	.10
	792		60.0–63.0	.8–1.4	.25	—	Rem.	11.0–13.0	—	—	—	—	.50	—	—
	794		59.0–68.5	.8–1.2	.25	—	Rem.	16.5–19.5	—	—	—	—	.50	—	.50

NOTES

A—Analysis is regularly made for the elements listed except Zinc. If, however, the presence of other elements is suspected or indicated in the course of routine analysis further analysis shall be made to determine that the total of these "other" elements is not in excess of the units specified.
B—These are high conductivity coppers which have in the annealed temperature a minimum conductivity of 100% IACS.
C—Small amounts of Cadmium or other elements may be added by agreement to improve resistance to softening at elevated temperature.
D—This includes Low Resistance Lake Copper and Electrolytic Copper.
E—This includes Oxygen Free Copper to which Phosphorus has been added in an amount agreed upon.
F—This includes High Resistance Lake Copper.
G—This includes permissible Selenium.
H—This includes Oxygen Free Tellurium Bearing Copper to which Phosphorus has been added in an amount agreed upon.
I—This includes Copper plus Silver plus Tellurium.
J—This includes Copper plus Silver plus Sulfur.
K—Nickel and/or Cobalt .20 minimum.
Nickel plus Cobalt plus Iron .60 maximum.
L—Including Aluminum and Lead.
M—Including Zinc
Note 1—Copper only.
Note 2—Copper plus tin plus phosphorus.
Note 3—Copper plus tin plus phosphorus plus lead.
Note 4—Copper plus elements with specific limits.

WHITMAN & BARNES

MAKERS OF FINE TOOLS SINCE 1838

DRILLS AND REAMERS

which drill really costs less?

Based on results, drills "A" and "B" (center and right, above) should cost 43% and 39% less than W & B drills (left, above)—instead, they can be purchased at *only* about 20% less.

Watch those *initial* costs—they may be *costly!*

W&B

PARTNERS IN PRODUCTION PROGRESS

COMPARATIVE DRILLING PERFORMANCE

General Purpose Jobbers Drills	*No. of holes per drill size					Total No. of Holes	Efficiency Rating
	#40	#30	1/8"	1/4"	3/8"		
W & B Drills	208	62	57	50	34	411	100%
"A" Drills	142	24	14	28	28	236	57%
"B" Drills	114	49	13	61	15	252	61%
Thickness of plate	1/32"	3/16"	1/2"	1"	1"	Material: Heat treated chrome nickel steel	

**In each drill size, five drills of each brand were tested and each drill was resharpened three times as required.*

Many drill performance tests similar to this one have been made. However, W & B will gladly conduct drill tests at *your* plant and under *your* conditions. Contact us direct or through your W & B distributor. He can offer this service plus fast delivery from complete stocks.

WHITMAN & BARNES

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS

MICRO SWITCH Precision Switches

Actual size: 1.63 x 1.63 x 3.75

Detects without touching ...sensor never wears out!

Honeywell Proximity Switch detects metal within ½ inch of the sensor—over 600 operations a minute!

Protect your products and your budget! This amazing new switch is the perfect answer where rough parts or corrosive atmosphere may damage a mechanical switch, or where the delicate finish of a product may be marred by physical contact. And think of the savings you'll realize with a sensor that has no moving parts to wear out—a sensor that need *never* be replaced!

The Honeywell sensor has a rugged stainless steel face. The sensing unit is sealed against cutting oils, water and humidity, sand and dust; can operate submerged if necessary.

A Proximity Switch can be your answer to difficult switch problems, but be sure it is a product of Honeywell research. Contact the nearby MICRO SWITCH branch office and ask for Data Sheet No. 163.

Plug-in relay in amplifier cuts downtime. Amplifier is separate, may be remotely located.

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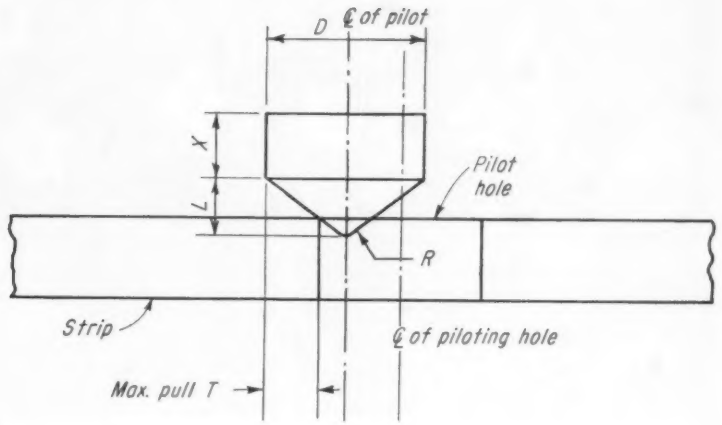
American Machinist / Metalworking Manufacturing

REFERENCE BOOK SHEET

Pilot Pins for Progressive Dies

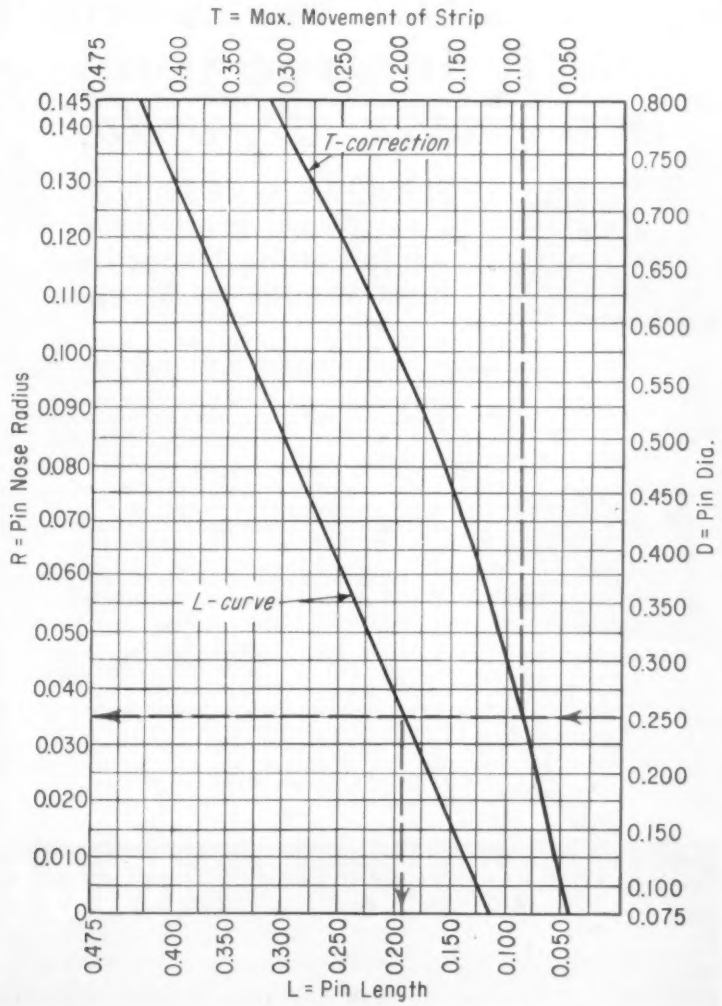


By Ferenc Kuchta,
mechanical engineer,
J Wiss & Sons Co, Newark, NJ

In progressive dies, the cam-actuated feed is set to feed the material less than the pitch. This amount of movement allows the pilots to pull the strip into the correct position and prevents overfeeding and buckling. On the nomogram the T - dimension means the maximum amount of this pull, which is less than $D/2$ because of the necessary point radius. (See sketch).

Example:
Material: 0.120 in. steel strip; pilot dia, 0.250 in.; $R = 0.035$ in.

Solution:
From $D = 0.250$, draw line on nomogram to $R = 0.035$ in. Where this line cuts the L curve, drop down to the L-scale and read read 0.190 in. And where the line cuts the T-curve, move up to the T-scale, and read 0.085 in. as the maximum distance that the pilot must pull the strip.



7 PLA-CHEK GAGES stand guard over Ford precision and accuracy in this Layout and Inspection room at Ford Motor Company's Dearborn engine plant in Dearborn, Michigan
1
2
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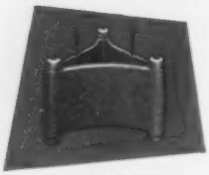
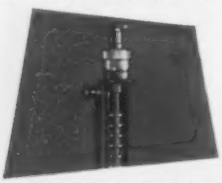
6
7

7 of 200 Reasons Why Inspections are *Faster at Fords!*



PRECISION RISERS

Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6" height for 6", 12", 18" PLA-CHEKS . . . 12" height for 24", 36", 48" models.



MICROMETER THIMBLE

Is graduated to .0001" and provides dimensions between 1" steps on measuring bar. Measuring bar of the 18" model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

PLA-CHEK GAGES Guard Ford Precision while Cutting Inspections from Minutes to Seconds

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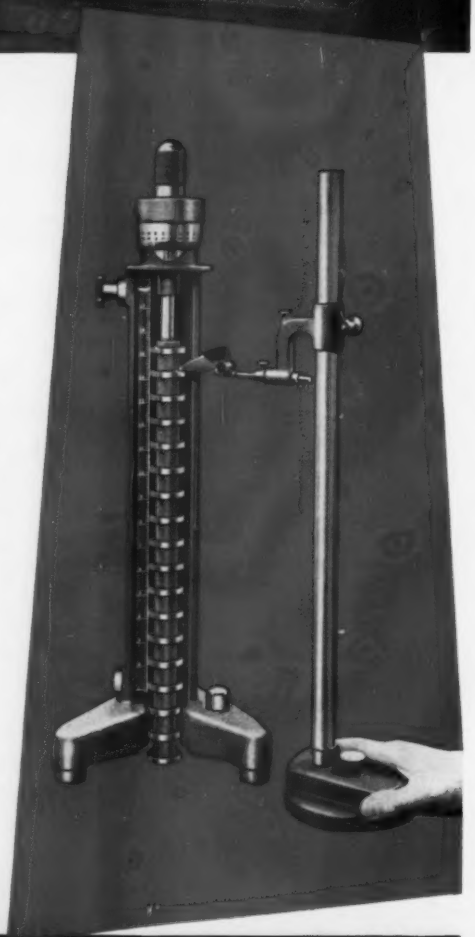

Cadillac GAGE COMPANY

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American Machinist / Metalworking Manufacturing

REFERENCE BOOK SHEET

Nomogram for Shafts

By F Caplan, Kaiser Engineers, Oakland, Calif

This nomogram graphically solves four of the most common equations (or combinations thereof) used in shaft selection:

(1) Torque, T lb-in., $= \frac{\text{hp} \times 63{,}000}{\text{rpm}}$, or

(1*a*) T, lb-ft $= \frac{\text{hp} \times 5255}{\text{rpm}}$

(Nomograph key: rpm — hp — T)

(2) Shearing stress, S, psi $= \frac{T}{d^3} \times 5.09$

for T in lb-in.; (Nomograph key:

T — d — S)

(3) Angle of twist, degrees, per 100 in. of shaft length,

$$\frac{\theta}{L} = 4.865\ 10^{-3} \times \frac{T}{d^4}$$; for T, in lb-in.

The above equation is for steel shafts ($E_s = 12 \times 10^6$). For materials other than steel, the angle of twist is inversely proportional to E_s. (Nomogram key: T —— d —— θ/L)

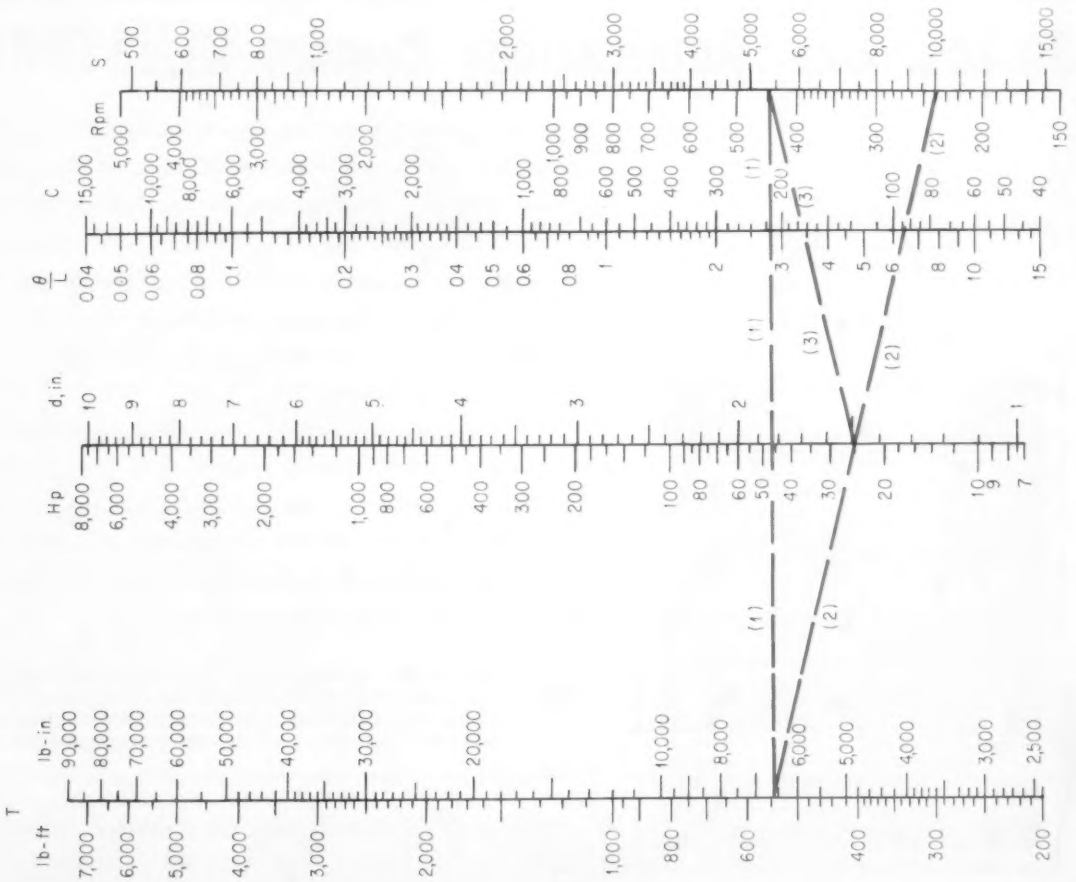
(4) Surface speed, C, fpm $= \pi/12 \times d \times$ rpm

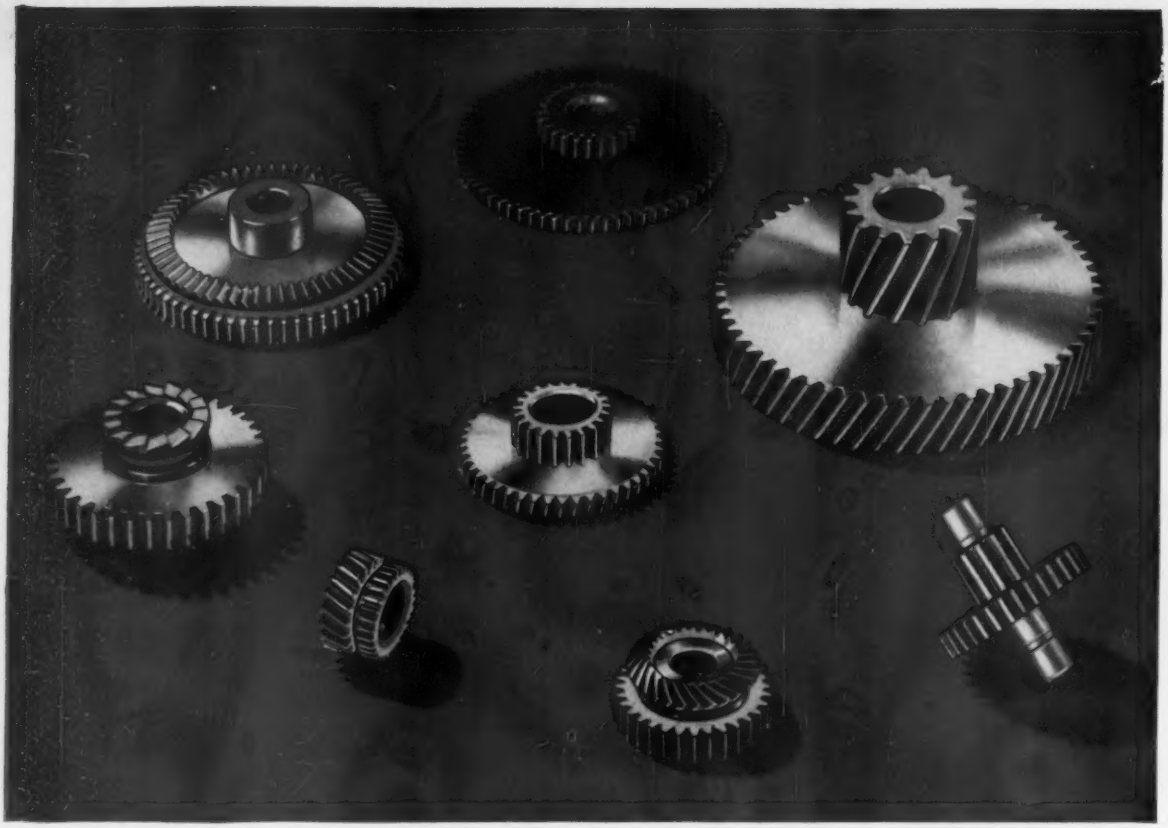
(Nomogram key: d — C — rpm)

NOTE: For values beyond the range of the scales, it follows from the defining equations that if scale values of hp are divided by 10 or 100 then the scale values of rpm and C must be divided by 10 or 100, etc.

EXAMPLE: What size of shaft is required to transmit 48 hp at 450 rpm if the shearing stress must not exceed 10,000 psi?

Align rpm = 450 with hp = 48 and read T = 6,700 lb-in.; align T = 6,700 with S = 10,000 and read d = 1.50 in. and θ/L = 6.4° per 100 in.; align d = 1.50 with rpm = 450 and read C = 177 fpm.





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Perhaps you have an irksome problem involving such clusters —or some other Small Gearing application. G.S. engineers will be glad to sit down with you and discuss solutions, in the light of our more than four decades of experience in every area of U.S. industry where precision Small Gearing is used in quantity. Why don't you write or phone us—today?

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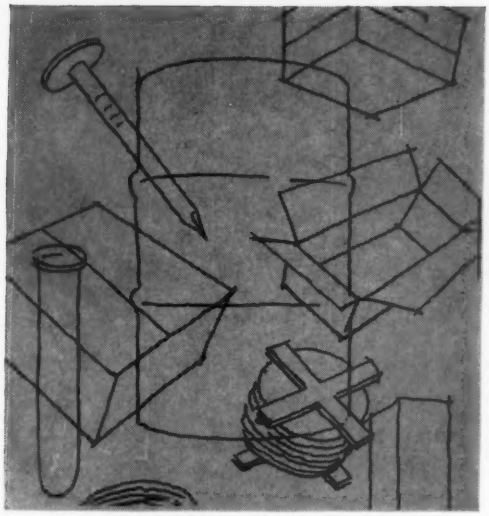

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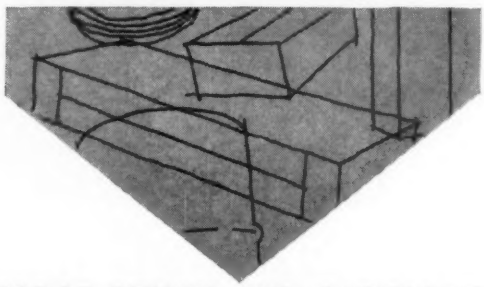

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Now you can "check weigh" anything for industry (from a one-pound can to a one-ton barrel), in, out, or all about more accurately—more economically! Modern Fairbanks-Morse Dial Scales provide proved accuracy that works for you, year after year. And—because our Scales are built to last longer, you realize long-life economy . . . freedom from repairs or early replacements!

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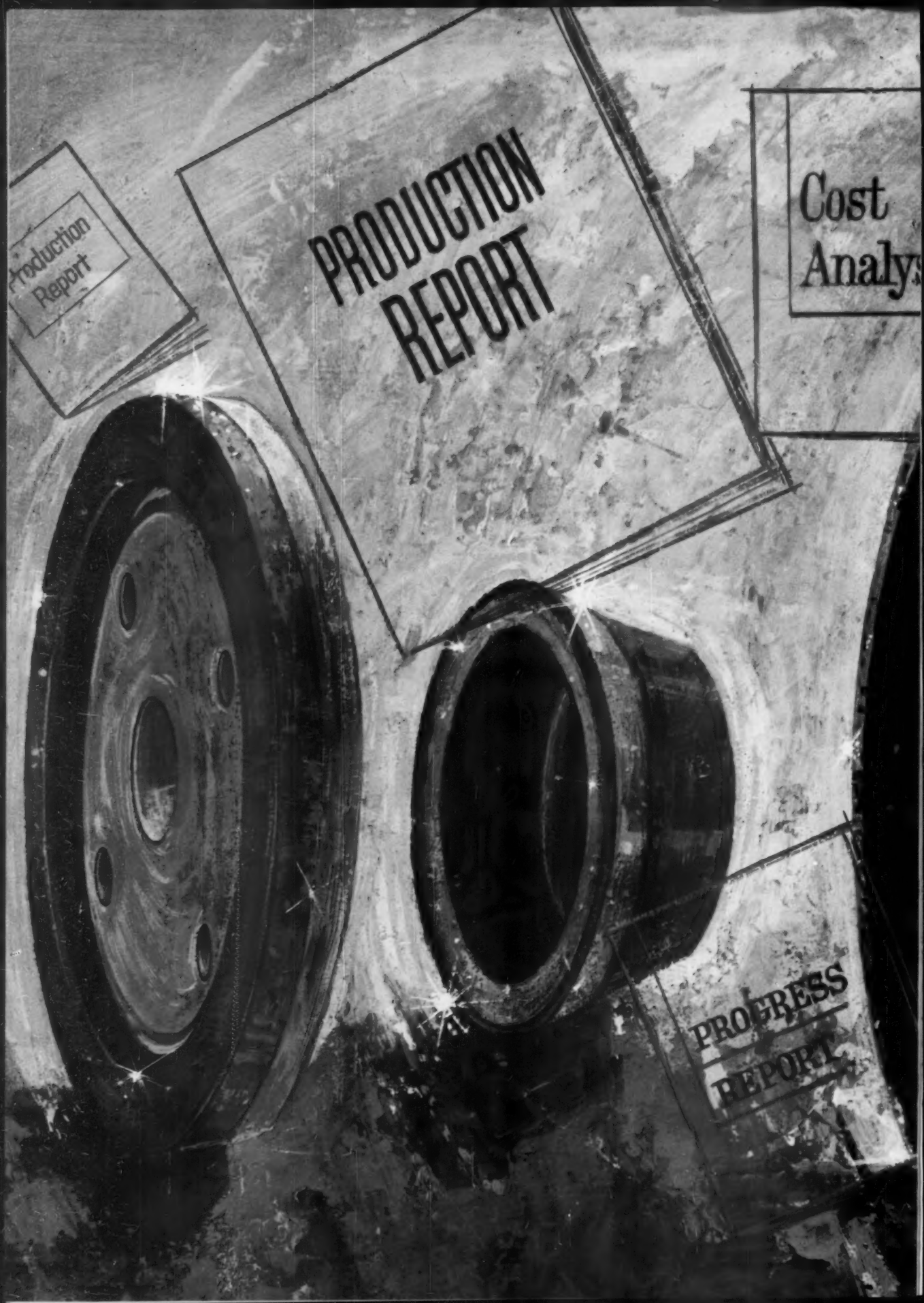
Production Report
PRODUCTION REPORT
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PROGRESS REPORT

G-E Man-Made Diamond's contribution to industry

In the few brief years since its introduction, General Electric Man-Made diamond has made important contributions to industry. Specifically, grinding wheel users receive these benefits when they choose wheels containing G-E Man-Made diamond:

Superior grinding performance with General Electric Man-Made diamond over mined diamond has been borne out time and time again. This adds up to one thing: More output per wheel when it contains G-E Man-Made diamond. That's like money in the bank!

Special crystals for all three bonds let you meet your grinding requirements exactly. Resinoid, vitrified, or metal—General Electric makes diamond perfectly suited for these bond types.

Consistent performance is assured by the uniform shape and structure of General Electric Man-Made diamond crystals produced by controlled manufacturing processes.

More to come. Just as General Electric has continually improved the characteristics of Man-Made diamond since its introduction, the future promises bright new things in diamond development. The perfection of special crystals for saws, drill bits, tools, wear parts and specialized abrasives may be a few of the things you can expect during the coming years.

Want to obtain the maximum output per diamond grinding wheel? Then follow the ever-increasing number of wheel users who are specifying G-E Man-Made diamond in the wheels they are ordering from their suppliers.

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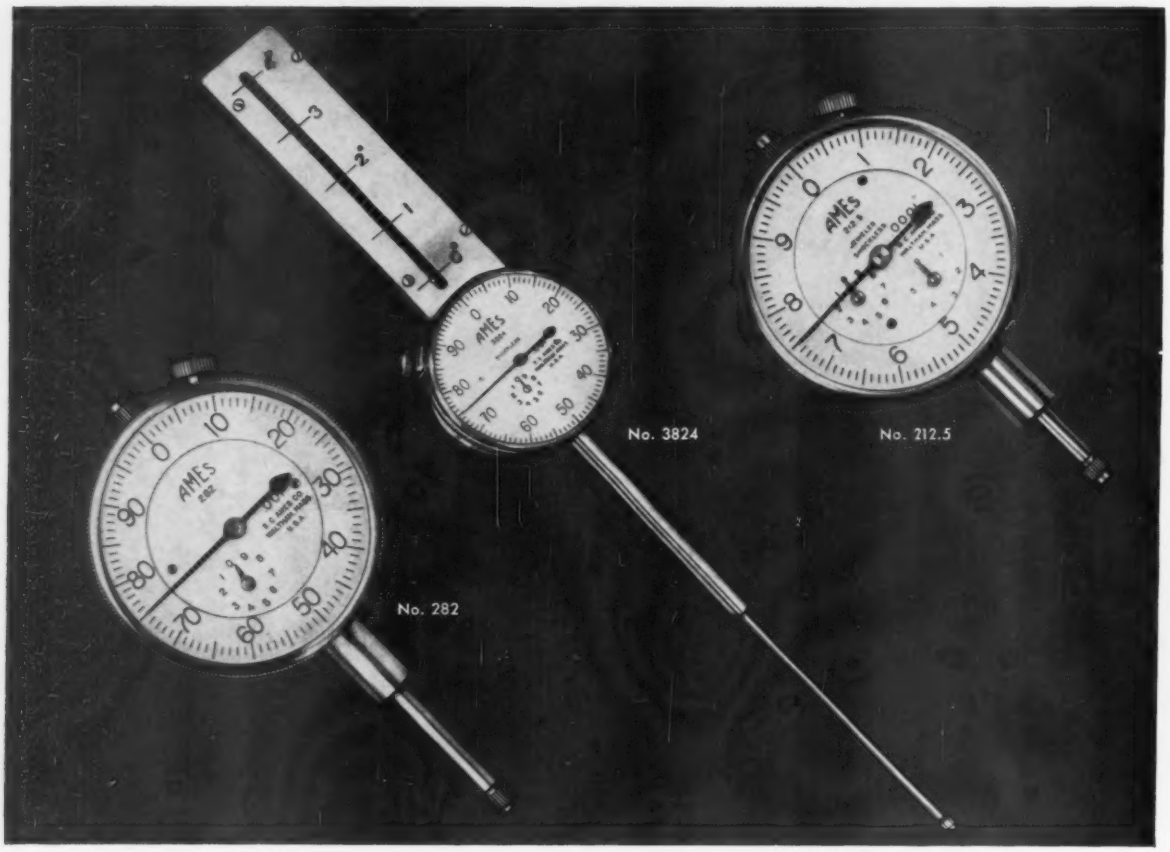

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Features Include: large diameter dials, widely spaced dial graduations, movable dials, replaceable contacts and count hands.

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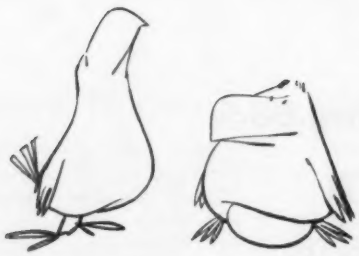
Talking Shop



TWIWI

TWO FACTORS that must be eliminated in doing a Value Analysis are the NIH reaction and the TWIWI Complex, according to a bulletin circulated in Lockheed. For the uninitiated, NIH is the tendency to discard an idea that was Not Invented Here. TWIWI, naturally, is the man who supports the idea because That's the Way I Want It!

Prompt

AS WE SEEM TO SINK into a growing pile of mail we can view with sympathy the plight of a company that returned not long ago a questionnaire we had sent out earlier. The postmark date was exactly 4 years and 29 days after the return deadline printed on the form.

We have a sneaking suspicion, however, that this one has been hiding behind the radiator of a post office, awaiting cancellation, all that time. Not even we are that far behind in our mail.

Big Springs

SPRINGS THAT STAND more than four feet tall, weigh half a ton, and are coiled from three-inch-diameter steel bars are being produced by American Steel Foundries. The big springs are for use in underground silos for missile launching. As many as 128 such springs go into a single silo to guard the missiles from shock waves of enemy bombs.

International Research

ONE MILLION DOLLARS will be spent by the National Bureau of Standards on research in India, Pakistan, and Israel to supplement the research the Bureau conducts at home. This money comes from US-owned foreign currencies.

Another use of foreign research is reported by Bowmar Instrument Corp. Bowmar has its own research department which does some research of its own, but it has farmed out some to European outfits. Bowmar did this through International Research Consultants in Geneva, a firm that serves as a liaison with universities, research firms, and industrial firms.

Hurry

YOU HAVE JUST over two weeks to report it if you think you have the oldest Thor power screwdriver still in service. Send the model and the serial number along with a description of the job to J L MacDonald. Thor Power Tool Co, Aurora, Ill. The oldest one will win $100 for the man reporting it. It will also be replaced with a new power screwdriver, "if desired."

Secret Weapon

THE SPARTAN CODE has long been thought to have been the major reason that Sparta was such a terror among Grecian cities. Now new evidence suggests that the secret was steel and that Spartan supremacy was the difference between a steel sword and an iron or bronze one.

Dr Lyle B Borst reports for the American Iron and Steel Institute that high grade ore deposits are known to have been located about 30 miles north of Sparta. Farmers today occasionally plow up lumps that are probably slag. Dr Borst has located the ancient furnaces and believes he has found descriptions of a carburizing furnace.

If the theory reported in *Steelways* proves to be correct, the Spartans managed to keep the secret from Athens for three hundred years—from 700 to 400 BC.

Doubt About Stainless

IT MAY BE HARD to believe, but just 31 years ago there was so much doubt about the durability of nickel stainless steel that when it was decided to sheathe the tower of the Chrysler Building in Krupp Austenitic made by Republic Steel, ten sheets were placed in storage for possible use as replacements. That type of steel is now known as Type 302 and the wooden case containing the spares has never been opened.

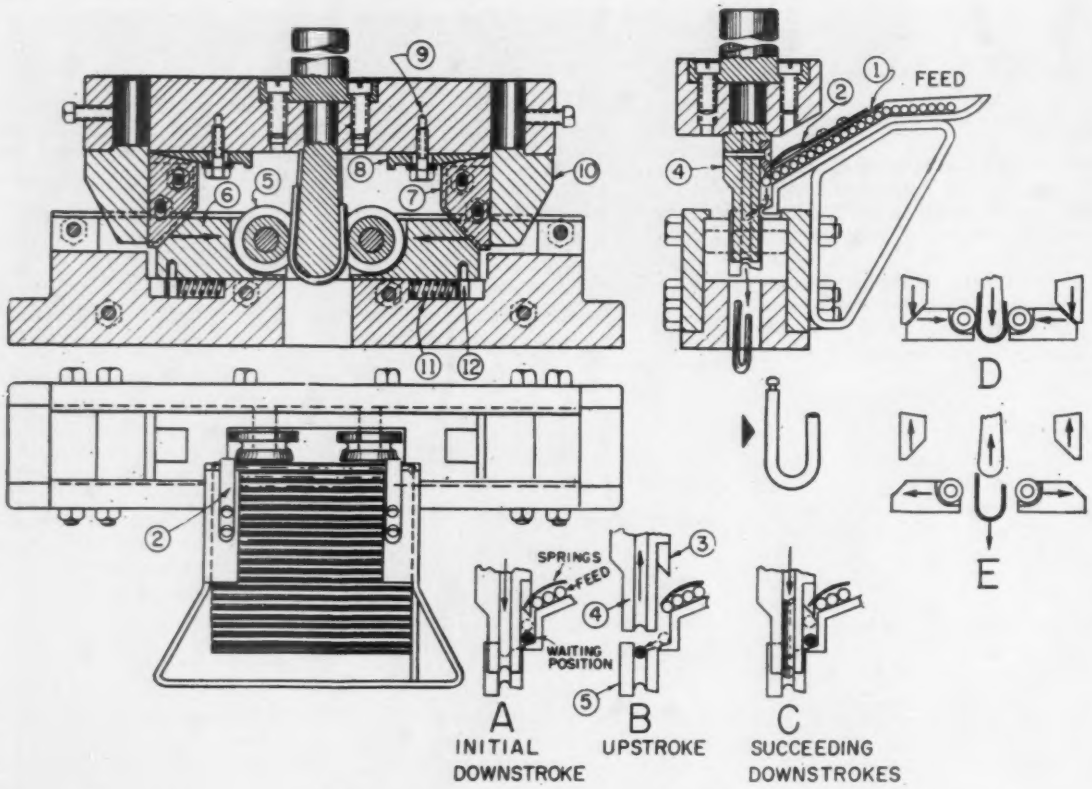
At least it wasn't opened until the spares were recently sent to the scrap pile.

Open-door Boxcar

AN ALUMINUM BOXCAR with sides that open completely for loading and unloading has been developed by the Southern railway and is being built by Pullman-Standard. The sides roll up like overhead garage doors and the center posts then slide to the ends. Alcoa is supplying 800,000 lb of sheet and extrusion for the first 200 cars. Barber-Colman is producing the three wide-span doors used on each side of each car.

Practical Ideas

Magazine-Fed Die Compensates for Spring Back



Forming of padlock hasps formerly required a bending operation, followed by a restrike to compensate for springback. This die is designed to finish form the hasp in a single operation by over bending, and has increased production several hundred percent, thus more than justifying its cost.

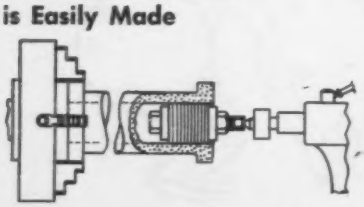
Rods, previously turned and cut to length, are loaded into a magazine *1*, but are prevented from entering the die by two flat springs *2*. As the ram descends, a finger *3* attached to the side of the bending punch *4* engages the lowest rod, pulling it out of the magazine and allowing it to drop into a waiting position on an inclined ramp. On the upstroke, the rod rolls into position over two grooved rollers *5* which are free to rotate on pins in the sliding blocks *6*. Adjustable blocks on top of these blocks provide endwise location.

As the punch engages the work it forms it into a U-shape. Then, as it continues down, the sliding cams *7*, held in the holders *10*, engage the tapered faces of the blocks *6*, forcing them inward to press the work against the back-tapered sides of the punch.

On the upstroke, the blocks are returned to the open position by the springs *11* and pins *12*. This allows the work to spring back to bring the arms parallel, and to drop clear of the punch. The amount of squeeze exerted by the blocks is adjustable by means of two wedges *8* retained by the screws *9*.

Hjalmar Dahl, Upplands Vasby, Sweden

Expanding Mandrel is Easily Made



We had to turn and face the flanges of a number of long cast-iron tubes and wanted to do both operations in one setup. We could not do this with a conventional pipe center, so we made up a special expanding mandrel which served very well. It consists of a heavy bolt with a center in one end, and two heavy steel washers. Several disks of hard die rubber are placed on the bolt between the two washers and are of such diameter that they will slip freely into the ID of the tube. Two flats are milled near the end of the bolt for holding it with a wrench while tightening up the nut. Just a turn or two on the nut will cause the rubber to expand and grip the tube tightly.

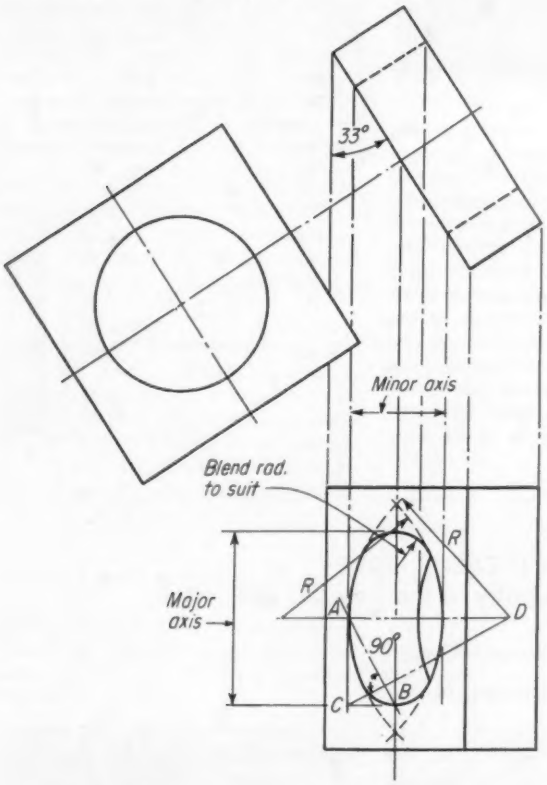
H Koslow, Bronx, NY

How to Draw an Ellipse

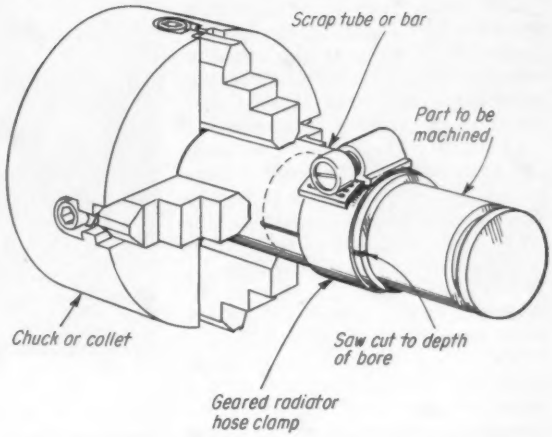
There are times when a regular ellipse templet will not apply, but this method of construction will be found quick and easy.

Project the major axis at the required angle, and draw the minor axis at right angles to it. Draw a line between the points A and B. From the point C draw a line at right angles to AB and continue it to intersect the minor axis at D. With center at D, strike an arc with radius R = DA. On the opposite side strike another arc with radius R, then blend in arcs at each end tangent to the major axis.

L A Wedler, Clawson, Mich



Hose Clamp Holds Work in Lathe



This method of holding work for second-operation turning or grinding is particularly useful when the pieces are short or are too big to be held in a collet, and where extreme accuracy is required. And it has the special advantage that it will not mar a finely finished surface. Also, it has the merit of being very cheap.

All that is required is a piece of scrap tubing or barstock held in an ordinary chuck and bored out to a slip fit for the parts to be held. The wall thickness should be between ⅛ and ¼ in., and there should be a saw slot across the end extending down to the bottom of the bore. The slot should be cut before boring.

The work is gripped by an ordinary radiator hose clamp of the type that has a little worm that engages teeth formed in the tail of the clamp. These are quite inexpensive and may be purchased at any auto supply store. They come in several sizes, and each size has a wide range of adjustment.

For extremely high precision work, where the diameter of the work does not vary more than one-quarter of a thousandth, the wall thickness of the holder should not be more than ⅛ in., and it should not be split. It is surprising how easily a worm-type clamp will compress an unsplit holder and thus hold the work extremely accurately.

H. Hansen, Jr, Fulton, Mo

Indicator Holder Banishes Mirror

We always thought that a mirror was necessary when indicating a hole true with the spindle of a jig borer or vertical mill, and we used one for a decade or more. We thought of buying a perpendicular-type indicator, which is good for this kind of work, but hardly for anything else, when we found out that a radial, or Last Word, indicator can be used like the perpendicular type with the aid of the new double-joint swivel holder. With this, the dial can point toward the spindle nose and is always visible to the operator.

These holders make it very safe and convenient to adjust the indicator for various hole diameters, and also to remove it after indication. To change from indicating inside to indicating the face of the hole takes only a few seconds by raising the indicator to its knee joint and turning the point through 90 degrees.

H Landauer, Tampa, Fla

Practical Ideas

Clamp Stops Spotweld Dimples

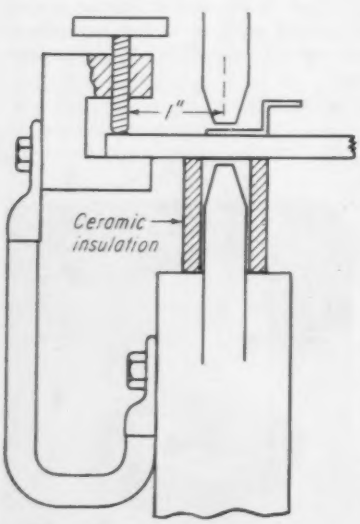
Spotwelding a 1/64-in. steel strip to a ⅛-in. 18-8 stainless steel plate may not seem like a particularly difficult operation. But when the opposite side of the plate has to have a highly polished surface, free of heat discoloration, it becomes a problem.

Conventional welding between two electrodes produces a deep dimple on the lower face, and it may be necessary to remove as much as 1/32 in. of stock to get rid of it. A large-diameter bottom electrode helps to reduce the dimple, but heat discoloration is still present and shows up, even after sanding and polishing.

We solved the problem by insulating the bottom electrode with a ceramic sleeve and connecting the electrode holder to a copper clamp by a piece of cable. The clamp is ⅝ in. wide and has a 2-in. throat and a 5/16-18 copper screw with a large knurled head. We clamp this to the edge of the work, keeping it 1 inch away from the top electrode so that each weld receives the same amount of heat. The clamp gets quite hot during welding, so we have to be careful in handling it.

Heat and pressure from the top electrode push the stainless plate down into the insulator and produce a small protrusion, but this is easily removed by belt sanding and there are no heat discoloration marks. It is to be noted that this method requires an increase in welding current from three to four times that for conventional welds.

Robert Micals, Freehold, NJ



Punch and Scale Save Layout

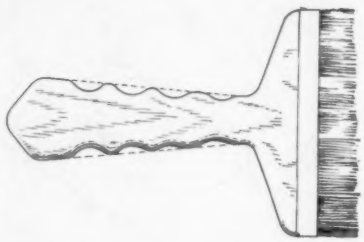
We had to do a job recently which involved drilling a hole in the center of each of a number of narrow slots milled across a long aluminum bar. It would have taken a lot of time and trouble to lay out and punch each one, so we made up a special punch from a piece of drill-rod turned to fit the width of the slots. We turned a point on one end and hardened it. Then we clamped a straightedge to the top face of the bar, positioning it so that when the OD of the punch touched its edge the point would be exactly in the middle of the slot. After that it was a simple matter to prick punch all the holes by resting the punch against the straightedge and tapping it with a hammer. In the illustration, the straightedge has been removed for the sake of clarity.

Howard Levy, Brooklyn, NY

Brush Handle Does Not Slip

Paint brush handles are always smooth, and when you are using a brush for applying oil, grease, kerosene, and other slippery materials it is easy to lose your grip on it. You can avoid this by forming four finger grooves in the handle with a half-round file or grinding wheel.

Fred Lettino, L I City, NY



VACUUM CHUCK IS EASILY MADE
Was the winning entry in the July 24, 1961 issue.

The $25 prize is awarded to:
Henry E Piltz, E Orange, NJ

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

PAYMENT—will be made as soon as tabulation is completed, and is in addition to the regular rate for the item published.

JUDGES—are a group of American Machinist/Metalworking Manufacturing readers who select articles they prefer in a particular issue. The group changes entirely with each issue and thus represents a true cross-section of readers. Their decision is accepted by the editors, without reservation or bias, as final in each case.

REQUIREMENTS—Items must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with AM/MM standards, and readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Names in the News

E W Bliss Co has appointed **Paul Jones** general manager of the Hastings (Mich) Division, manufacturer of complete lines of metalworking presses and container making machinery. Mr Jones was formerly factory manager of the division

Joy Manufacturing Co, Pittsburgh, has elected **John W Thornton** vice president and general manager of the Industrial Division. He was previously vice president, marketing.

Hevi-Duty Electric Co, Watertown, Wis, has named **Robert E Morken** product manager in charge of melting furnace engineering and sales. Mr Morken was formerly a consultant on heat-treating and metal melting for the corporate manufacturing staff of Chrysler Corp.

Detroit Broach & Machine Co, Rochester, Mich, has named **Hugo Swan** superintendent of the Machine Division. He was formerly associated with the Gleason Works as production manager.

Yoder Co, Cleveland, has named **William J Kerr** vice president, development. He has been vice president, production, since 1946. **Charles J Lantz** has been appointed director of production

Black & Decker Manufacturing Co, Towson, Md, has named **Arthur S Boehm** sales manager of its Industrial-Automotive Division. He was formerly eastern regional sales manager of the division.

Erie Foundry Co, Erie, Pa, has named **J E Wilson** general sales manager. He was formerly associated with General Electric Co in sales capacities.

Standard Tool & Manufacturing Co of Kearny and Lyndhurst, NJ, has named **Z E Zilahy** director of the Contract Engineering Division. He was formerly associated with American Can Co, specializing in the design and development of high speed automatic machinery.

Baird Machine Co, Stratford, Conn, has appointed **Frederick Olsen** plant superintendent. He has been superintendent of the tool room since 1955

American Motors Corp has named **Julius A Riedl** assistant manager of manufacturing for the automotive division. **William F Poupard** has been appointed works manager of the company's Milwaukee Body plant, succeeding Mr Riedl.

International Business Machines Corp has appointed **Samuel B Korin** manager, manufacturing equipment development. He was formerly administrative assistant to IBM's director of manufacturing research.

Stanley Works, New Britain, Conn, has appointed **Ira G Cruckshank** manager of engineering of Stanley Steel Strapping, a company division. Mr Cruckshank was formerly manager of manufacturing engineering for GE's Hotpoint Division.

continued on page 236

Pressed Metal Institute officers elected for the coming year are, left to right: president, **W J Primrose Jr,** vice president of **Dickey-Grabler Co,** Cleveland; first vice president, **C W Cederberg,** treasurer and general manager of **Larson Tool & Stamping Co,** Attleboro, Mass; second vice president, **C C Caditz,** who is president of **Northern Metal Products Co,** Franklin Park, Ill

You don't have to baby it—Ledloy® steel actually performs at its highest efficiency when you really push it! ■ Take a tip from the many shops getting amazing results with this go-the-limit steel. Increased machinability, higher speeds and feeds, reduced tool wear with greater production per tool change—all these advantages are yours—if you push Ledloy steels. ■ Inland pioneered in the making of leaded steels—has the solid background that means dependable recommendations for your kind of operation and your specific product. Be sure the leaded steels you use are Inland Ledloy steels—the result of more than 20 years of research, development and continuous production. Ledloy steels are available from your Cold Drawer or your local Steel Service Center. Send for "Properties of Ledloy Steels," an informative booklet Inland will be glad to mail at your request.

LEDLOY® STEELS CAN TAKE IT!

the world's most machinable steels

INLAND STEEL COMPANY

30 West Monroe Street • Chicago 3, Illinois

CIRCLE 345 READER SERVICE CARD

Wesson Cast Tool Alloys Bridge Gap Between High Speed Steel And Carbide

Two alloys, composed principally of cobalt, chromium and tungsten, but with columbium carbide added to lower the coefficient of friction, are introduced for general and high-speed machining.

Wessonite H is recommended for machining of ferrous and non-ferrous metals, and Wessonite HX is designed for minimum shock or impact machining.

The alloys are produced in electric furnaces and cast to form. No heat treating is used in the production, inherent hardness is gained through chill-casting. The alloy is claimed to have a red hardness far superior to high speed steel and second only to cemented carbides.

Cutting speeds range from 100 to 190 sfpm for cast iron, from 50 to 300 sfpm for steels and up to 1250 sfpm for aluminum. This is said to put the alloys in a category above high speed steel but below carbides.

Wessonite H is available in solid tool-bits, cut-off blades, tipped tools and preformed tools and blanks. Wessonite HX is available in square, rectangular, and round tool bit sizes. In addition, the company can furnish lathe tools with solid blanks, or with blanks set into the corners of the shanks, and shell end mills tipped with Wessonite.

Wesson Corp, 1220 Woodward Hts, Blvd, Ferndale, Mich

MORE DATA? Circle 85, inside back cover

Enthone Solvent is Single-Dip Stripper for Rust, Oil, Paint

Endox-L-76, an alkaline solvent for rust, oil and paint removal allows single-dip treatment of steels, copper, brass, and magnesium. A non-flammable combination of solvents, chelating agents, and strong alkalies, it is used full strength at temperatures of 170 to 220 F to soak-clean oily, smutty, or rusty steel prior to painting or for removing phenolic enamels from ferrous and non-ferrous metals. 5 to 15 minutes is usually sufficient for removal of heavy rust or paint coatings with the cleaner, which sells for $155 a gallon in 5 to 55 gallon drums.

Enthone, Inc, New Haven, Conn

MORE DATA? Circle 86, inside back cover

One-Part Adhesive Requires No Mixing, is Permanently Flexible

Rubbapox contains neither water nor solvents but is 100 percent solids, and unlike epoxies it is a one part adhesive that requires no mixing prior to use.

The adhesive is waterproof, resistant to acids and alkalies and will adhere to most surfaces including polyethylene.

Recommended for laminating polystyrene foam, polyurethane foam, and polyethylene foam to aluminum, steel and Cycolac, Rubbapox remains permanently flexible and reportedly gives excellent service at temperatures ranging from −80 to 250 F.

Rubba, Inc, 1015 E 173 St, New York, NY

MORE DATA? Circle 87, inside back cover

Garlock Nylon Pressure Tubing Has Rating From 1,000 to 2500 psi

Nylon pressure tubing withstands temperatures from −40 to 185 F and is also resistant to corrosive oils, greases, dilute acids and alkalies. The lightweight tubing (1/7 the weight of copper tubing) has a pressure rating of 1000 to 2500 psi in different grades. Available in sizes from ⅛ to ½ in., it is suitable for hydraulic, lubricating and chemical lines.

Garlock Inc, Palmyra, NY

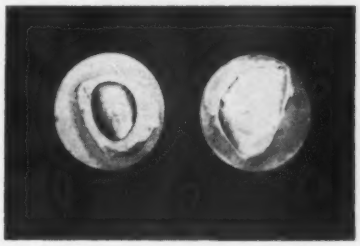
MORE DATA? Circle 88, inside back cover

Lubricating Wax Aids Stamping, Impact Extrusion of Hard Metals

Acetolube D2S, a lubricating compound for metal rolling, extrusion and stamping of hard metals has a melting point of 280 F and a decomposition temperature over 570 F in air and 700 F in the absence of air. Recommended also for wire drawing and molding of powdered metals, the lubricant sells for $2.35 a pound in commercial quantities.

Aceto Chemical Co, Inc, 40-40 Lawrence St, Flushing 54, NY

MORE DATA? Circle 89, inside back cover



Alpha Rosin-Core Solder Gives 33 Percent Greater Flow

Increased wetting, greater reliability of solder connections, and more joints per pound are benefits claimed for a new rosin-core solder. Said to give 33 percent greater flow, the solder consists of a solder-wire center core coated with flux, then covered with an outer sleeve of solder. It is available in all alloys of tin and lead and can also be furnished in tin-lead-silver for soldering silver-fired ceramic parts. Diameters available start at 0.32 in.

Alpha Metals, Inc, 56 Water St, Jersey City 4, NJ

MORE DATA? Circle 90, inside back cover

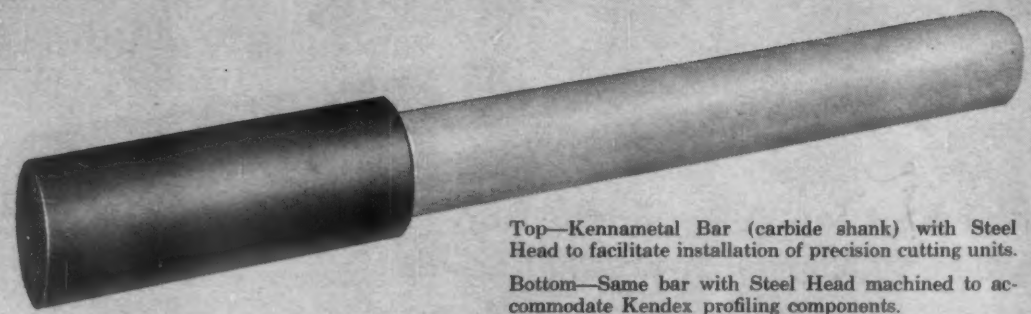
Oil Soluble Corrosion Inhibitor Mixes With Water, Oil, Solvents

Nopcochex D, an oil soluble corrosion inhibitor can be mixed with water, conventional oils or solvents to prepare several types of rust preventatives. Depending on the concentration of a water blend, metal parts can be protected up to 6 months. The preservative can be removed with conventional degreasing solvents or alkali cleaners and is prepared in the same way that coolants are; the concentrate is poured slowly into water and stirred.

The blends can be applied by brushing, dipping, or spraying to bar stock, sheet steel, and tools.

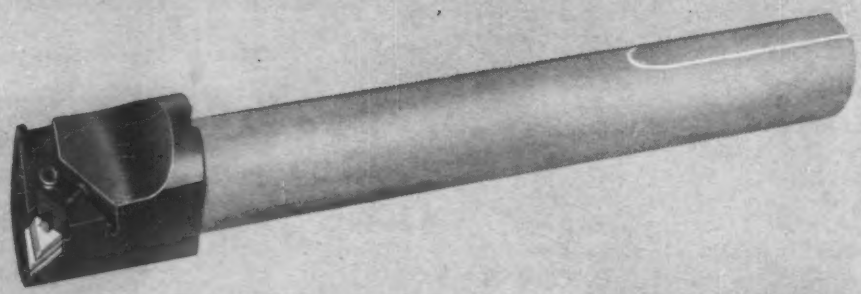
Nopco Chemical Co, Newark, NJ

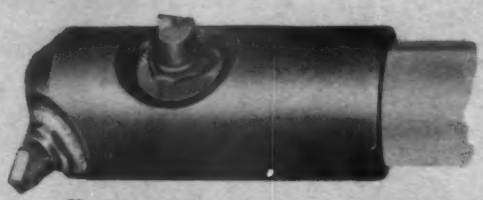
MORE DATA? Circle 91, inside back cover



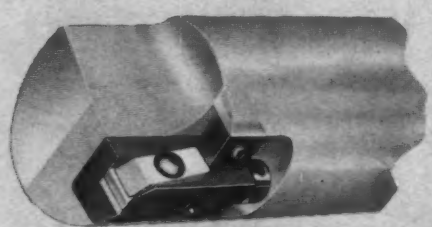
Top—Kennametal Bar (carbide shank) with Steel Head to facilitate installation of precision cutting units.

Bottom—Same bar with Steel Head machined to accommodate Kendex profiling components.





Kennametal Semi-Finished K-Bar converted to accommodate adjustable boring head.



Kennametal Semi-Finished Bar with Kendex Adjustable Unit installed.

NOW KENDEX* K-BARS WITH STEEL HEADS FOR MAKING "SPECIALS" FAST

10 STOCKED SIZES FOR MANY APPLICATIONS

This new line of Kennametal* bars, attached to machinable steel heads, speeds the making of special tooling to produce straighter holes and better surface finishes on precision boring jobs.

With these bars you get all of the advantages of Kendex K-Bars with shanks of rigid Kennametal, plus speedy adaptability to meet requirements of a wide range of boring operations. The rigid Kennametal shank (94,000,000 psi vs. 30,000,000 for hardened steel) minimizes deflection and reduces chatter by damping vibration. K-Bars permit greater length-to-diameter ratios to be used, and feeds and speeds to be increased. Closer tolerances can be maintained. Extra boring and grinding operations are often eliminated to further reduce unit costs.

The steel heads (28-32 Rockwell C) can be machined for various types of cutting inserts—such as Kendex adjustable units or other types of precision cutting mechanisms. The steel heads provide a generous amount of stock to provide for any tooling normally required on a particular bar diameter.

Ten sizes of semi-finished K-Bars are available from stock. Bar diameters range from $\frac{7}{16}$" to $2\frac{1}{2}$" . . . steel head diameters from $\frac{3}{4}$" to $4\frac{5}{8}$". Bars range in length from $7\frac{5}{8}$" to $28\frac{1}{4}$". Bars with shank diameters of $\frac{3}{4}$" and larger have a coolant hole through the center.

For complete information, call your Kennametal Carbide Engineer. He has a desk demonstrator that lets you *feel the difference* in the rigidity of Kennametal and steel. And he can show you samples of surface finishes produced by K-Bars and steel bars, under identical conditions, that demonstrate the value of Kennametal's high rigidity. KENNAMETAL INC., Latrobe, Pa.

*Trademark

35808

INDUSTRY AND KENNAMETAL

...Partners in Progress

Inexpensive Epoxy Adhesive Is Mixed in Equal Parts by Volume

Bondmaster M666 is a two component epoxy industrial adhesive mixed in equal parts by volume instead of odd ratios by weight. The adhesive, which sells for less than $8 a gallon has a red-colored "Part A" and a clear amber "Part B" that are mixed until the striations of color disappear and a uniform tint is achieved. The adhesive can then be applied with a spatula, trowel, brush or spray. The red color gives a quick check of uniform coverage.

Fully cured metal-to-metal bonds tested at room temperature show a yield strength of 3,500 psi, and bonds with expanded styrene foam withstand 175 F for 200 hr without cell attack, according to the manufacturer.

Bonding time at room temperature is 24 to 48 hr for 85% strength but faster cures can be achieved with heat; 300 F for 10 min is the maximum.

Rubber & Asbestos Corp, 225 Belleville Ave, Bloomfield, NJ

MORE DATA? Circle 92, inside back cover

Aluminum Bright Dip Additive Reduces Fuming, Drag-out, Pitting

New additive for aluminum bright dipping ,called LS'N reduces fuming, drag-out, pitting and streaking. The manufacturer says that LS'N saves twice its cost and is suitable for any of the phosphoric-acid-based dips. 1% by volume is required of the additive, which is stable at all concentrations and temperatures.

Alchemize Corp, 625 S Kolmar Ave, Chicago 24, Ill

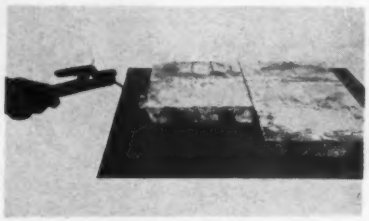
MORE DATA? Circle 93, inside back cover

Low-Cost Brightener Developed For Zinc Barrel Plating Lines

Single, low-priced one-shot brightener, called Econobrite, averages only 6 to 10 cents per barrel-hour. Brightness is said to be meter-proved as equal or superior to any premium-type commercial system. The brightener requires no boosters, and reportedly surpasses most commercial brighteners for throwing power, and resistance to temperature and contamination.

R O Hull & Co, 1260 Marion Court, Cleveland 16, Ohio

MORE DATA? Circle 94, inside back cover



Fusion-Cast-Refractory Can Be Welded In Place

Fusion cast, abrasion-resistant refractory is designed to be welded into place for quicker, easier installation and lower cost. Each shape of the new refractory contains a partially exposed steel lug which is arc-welded directly to the shell or structure to be protected. To facilitate flush mounting a relief area has been provided on the face of each piece. Standard shapes such as rectangles are used.

The crystalline-structured material is said to be able to withstand abrasive attack longer than other materials conventionally used in chutes, gas washers, and pipe liners.

Bulk density of the material is 210 lbs per cu ft, cold crushing strength averages 24,300 psi, and modulus of rupture averages 3,670 psi.

The material, which is produced by melting zirconia-alumina-silica to a liquid state in an electric arc furnace at temperatures exceeding 3200 F and then casting it to the desired shape, is presently available in 1, 2, 3, or 4-in. thick tapered or straight rectangulars and in 4 to 12-in. pipe liners and covers.

Corhart Refractories Co, 940 Commonwealth Bldg, Louisville, Ky

MORE DATA? Circle 95, inside back cover

Spring Steel in Widths to 48 in. Available From Sandvik

Cold-rolled, hardened and tempered spring steel with a tensile strength of 170,000 psi and a hardness (Rh C) of 38 is available in widths up to 48 in. and in any desired length.

Company maintains that the material is not commercially available in these widths from any other source.

Sandvik Steel, Inc, 1702 Nevins Rd, Fair Lawn, NJ

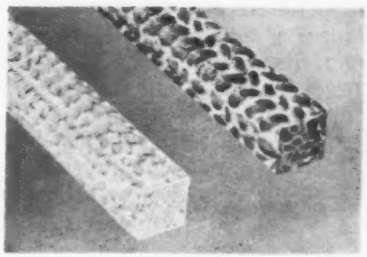
MORE DATA? Circle 96, inside back cover

Swepco Synchro-Welded Pipe Has Smoother Surfaces on ID, OD

Pipe made with synchronized fusion welding on both the OD and ID eliminates root bead problems and is said to give a smoother surface on both diameters than commercial pipe. Available from 5 to 12 in. IPS in schedules 5 and 10, the pipe is said to gain service life expectancy, and fatigue strength from the Synchro-Weld process.

Swepco Tube Corp, 1 Clifton Blvd, Clifton, NJ

MORE DATA? Circle 97, inside back cover



Carbon-Free Teflon Filament Packing Simplifies Break-in

Pure white filament packing with all impurities removed simplifies break-in after packing installation. Formerly, the gray-brown Teflon packing which had carbon impurities gave difficulties in break-in because the carbon oxidized at the high temperatures caused by break-in friction and created even higher temperatures. The new packing, offered as Palmetto Style No 1367 adds purity to the longer life (up to ten times that of asbestos), inertness, heat resistance, and low coefficient of friction of Teflon packings.

Green Tweed & Co, North Wales, Pa

MORE DATA? Circle 98, inside back cover

Solution Joins With Zinc To Protect Galvanized Coatings

Top-Galva is a metallic solution that can be brushed, dipped or sprayed on galvanized metal and will form a union with the zinc to give a non-corrosive, non-chipping coating. This coating also provides a good paint-adhesion surface and is said to eliminate chipping, peeling, and blistering.

The protective coating, which will cover 2000 sq ft per gallon, is available in 5, 15, or 50-gallon containers.

Riptrude Corp, 110 Gateway Rd, Bensenville, Ill

MORE DATA? Circle 99, inside back cover

Simplified method of checking for

GEAR ANGULAR ERROR

RICHARD L. THOEN
General Mills, Inc., Minneapolis, Minn.

Experience has shown that the great bulk of angular error patterns are relatively smooth. As a consequence, the maximum angular error can be established with about 10 readings. Thus, instead of a separate indexing instrument, angular error can be checked with a small optical polygon mounted directly on the gear mounting arbor (or gear shaft), Fig. 1, thus eliminating the bothersome measurement errors due to (a) runout of an indexing spindle, (b) the driver coupling between an indexing spindle and the gear mounting arbor (or gear shaft) and (c) skewness between an indexing spindle axis and the gear axis. It should be noted that the polygon mounting is not critical. A decentered polygon introduces no error, and the effect of wobble is usually insignificant.

Gear roll tester used

A gear roll tester is ideally suited for checking angular error, Fig. 2. The measuring slide is set to the proper center distance (i.e., to the center distance at which the pawl contacts the work gear inside form radius) and locked. The polygon is mounted on the gear mounting arbor (or gear shaft). The gear and pawl are mounted in the roll tester, the micrometer brought to the mid-position and the autocollimator is zeroed on a polygon face. To measure angular error, the pawl is rotated out of mesh, remeshed so as to bring an adjacent face into view, and the angular error is read in the autocollimator. The friction in the mounting centers is sufficient to keep the driven profiles in contact with the pawl.

In cases where the number of work gear teeth is not a multiple of the number of polygon faces, a slight pawl rotation (never more than ½ tooth) is necessary. If the number of pawl teeth is not less than 40 (on a full circle), the pawl rotation will never exceed ±4.5°. Over this range, for a suitable arm length, it is usually permissible to use the approximation 0.001 inch/minute of arc in presetting the pawl.

If desired, peak readings can be checked for the possibility of higher peaks by comparing changes in micrometer settings against corresponding changes in autocollimator readings.

A side advantage of checking for angular error on a gear roll tester is that erratic readings can be checked for dirt and burrs by simply releasing the measuring slide lock and reading the tooth-to-tooth composite error.

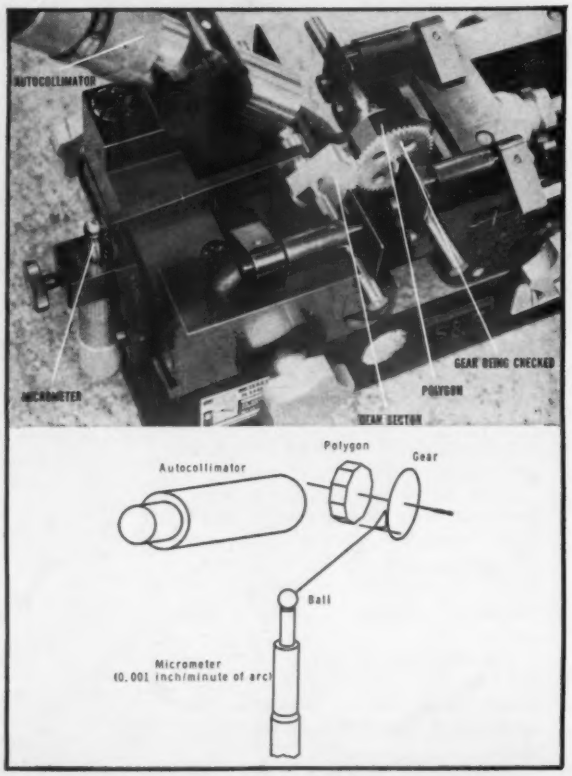
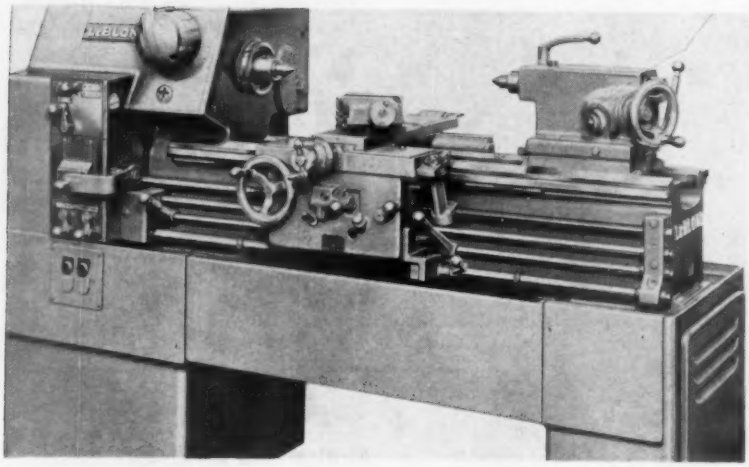


FIG. 1. A simplified method of checking for gear angular error.

FIG. 2. An S & F gear roll tester set-up for checking angular error.

The foregoing was extracted from a paper presented at the International Conference on Gears and Gear Drives held at Essen, West Germany, October 18 and 19, 1960. It is presented here as a service to the fine-pitch gear industry. Reprints are available on request to Gear Division, Kurt Orban Company, Inc., 1259 U.S. Route 46, Parsippany, N. J.

KURT ORBAN
COMPANY, INC.
1259 U.S. Route 46, Parsippany, N. J.



LeBlond Toolroom Lathe Has Apron Reverse To Leadscrew, 16 Lever-Selected Speeds

New Dual Drive tool and diemaker's lathe has, as special toolroom features, apron reverse to leadscrew, single-lever selection of 16 speeds from 31 to 2400 rpm and a built-in horsepower meter.

The lathe's 5-hp motor powers the headstock through 12 gear-driven lower speeds and 4 belt-driven speeds in the high range. A new electric clutch and brake gives positive stops and starts.

Apron reverse feature has a single lever that engages both cross and length feed through a positive-jaw clutch, and a single trip for feeding and chasing in each direction (spindle forward only) is standard. Both cross feed and compound rest have quick-set dials.

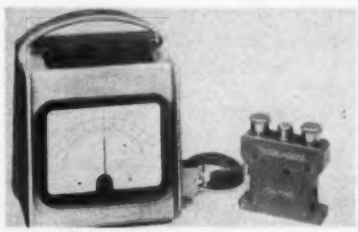
The automatically lubricated, totally enclosed quick change box gives 48 feed and thread changes and has a safety interlock that prevents engagament of coarse feeds while in the high-speed range.

With replaceable hardened and ground steels ways and the company's compensating veeway principle, the lathe transmits cutting forces into the bed efficiently for minimum wear.

Other design features include a dial at the end of the headstock spindle for indexing when chasing multiple threads, a dial to measure tailstock spindle travel, and the company's thrustlock tailstock for full length support of the tailstock spindle.

R K LeBlond Machine Tool Co, Cincinnati 8, Ohio

MORE DATA? Circle 51, inside back cover



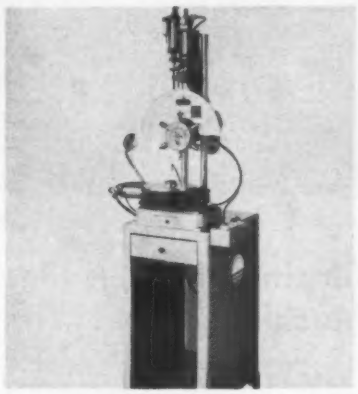
Electronic Level Checks At Distances Up to 300 ft

Battery-operated Talyvel is a precision instrument in which the standard bubble is replaced by a pendulum and a pair of variable inductance transducers which provide an electrical displacement signal amplified to feed a center-zero meter. The transistorized amplifier and meter is scaled both in angular measure as well as linear to indicate precisely the amount of tilt of the Talyvel unit. Pointer comes to rest in about one second.

Unit can be mounted in places where it would be difficult to read a block level; the meter unit can be placed at a distance up to 300 ft from the level unit, where it can be conveniently seen and read. The instrument is said to be particularly valuable for such applications as machine tool testing, releveling and adjustment, and machine tool research.

Engis Equipment Co, Div of Engrg & Scientific Instrumentation, 431 S Dearborn St, Chicago 5, Ill

MORE DATA? Circle 52, inside back cover



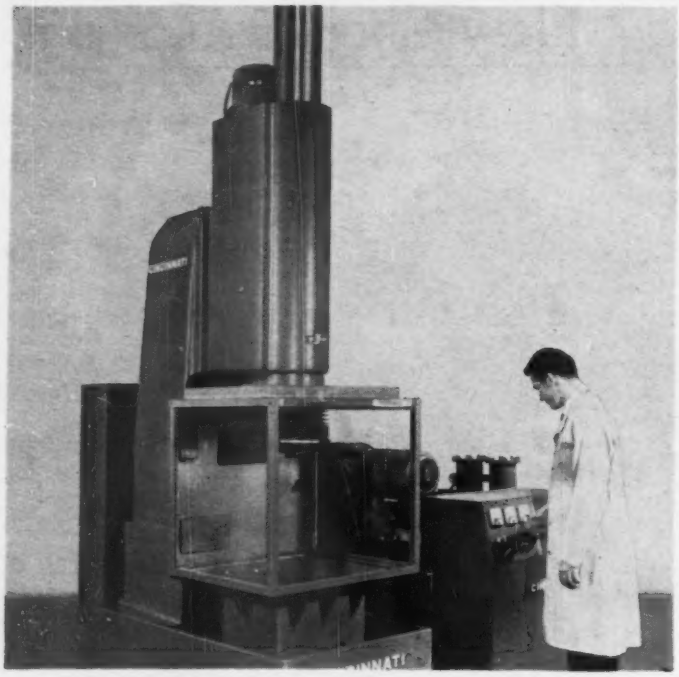
Burgmaster Bench Model Drills Can Now Do Deep Hole Drilling

A reciprocating feed arrangement, available as optional equipment for deep hole drilling on all Burgmaster automatic bench model turret drilling machines, simplifies drilling of extremely small holes and permits a range of speeds from 350 to 21,000 rpm.

The feed arrangement permits drilling to a certain depth; retracting to the top of the workpiece; rapid traversing down to the previous stopping point of the drill; drilling another increment (as desired); retracting to the top of the work to clear chips; and then repeating the cycle until final depth is reached. At this point the drill is rapid traversed to the top of the stroke, indexed to the next tool, and continues the machining cycle. Depth setting and rapid traverse are set on an electronic device to control the depth for each stroke and withdraw the drill any number of times to suit the work involved.

Burgmaster Corp, Small Tool Div, 15001 S Figueroa St, Gardena, Calif

MORE DATA? Circle 53, inside back cover



Cincinnati Enters Electrochemical Machining Field With Two Models

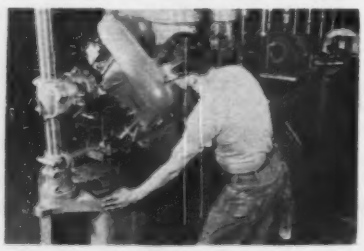
Company's entry into the manufacture of electrochemical machines is marked by the introduction of two models; the No 0 and No 1. No 0 machine has 8 in. quill traverse and the No 1 has 22 in. traverse. A solid table or moving table saddle unit can be supplied for either machine.

The machines have an anti-friction bearing for the quill, plexiglass enclosed area, and an electrolyte reservoir supplied by a 400 psi, 20 gpm pump. Since high amperage is necessary for these machines the company will furnish power supplies in 1000, 1500, 3000, 5000 and 10,000 amperes capacity.

These power units operate between 1.5 to 24 vdc and have automatic voltage or current stabilization.

The Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 54, inside back cover



Rockwell Unidrill Tilts 45 Degrees For Angle Drilling

The Unidrill can be moved and positioned instead of the work so that an operator saves steps in drilling large workpieces. Because of a double-swivel design the operator can tilt the head 45 degrees left or right to accommodate angle drilling. This feature is in addition to the normal head movements which include; displacement up and down on the main column, 360 degrees around the column or the mounting post, and in and out from the column.

With six interchangeable spindles or spindle adapters the drill will perform drilling, counterboring, reaming, spot facing and buffing. Its 23½ by 25⅛-in. table has parallel T slots and 1½-in. front and side clamping ledges. The dual purpose handle, mounted so that it is always in easy reach of the operator, positions the head and clamps it.

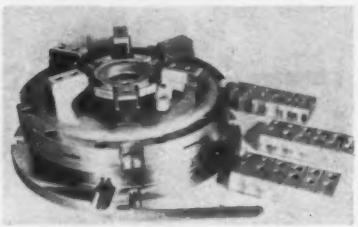
The drill has a capacity of ½ in. dia in cast iron and ⅜ in. in steel, and with its reach of more than two feet from the column to the spindle, it will make holes anywhere in workpieces up to 48 in. in diameter.

It will be avilable in eight models —with utility or deluxe head, slow or high speed pulleys and with Morse Taper or key chuck spindle. All models can be furnished as bench or floor type machines.

Accessories include a multi-speed attachment that gives 12 different speeds from 185 to 10,800 rpm.

Rockwell Mfg Co, Power Tool Div, 492 North Lexington Ave, Pittsburgh 8, Pa

MORE DATA? Circle 55, inside back cover



Air-Operated Diaphragm Chuck Has 0.00015-in. Repeat Accuracy

Chuck has extra-short overhang and special hardened and ground master jaws. The workpiece is chucked and released by compressed air operating on a piston which flexes the steel diaphragm, opening the jaws the necessary few thousandths of an inch. When pressure is removed, the diaphragm flattens, closing the jaws and gripping the work. Chucks can be constructed with a double-acting piston for push-pull operation where additional grip is needed. High concentricity is a characteristic of these units.

The chuck shown employs one of two available styles of special master jaws. Jaw sets for different jobs are interchangeable and may be changed without affecting accuracy. Diaphragm chucks for internal or external chucking are made in 5½-in. dia 3-jaw models, 7-in.-dia 4-jaw, and 10-in.-dia 6-jaw sizes.

Erickson Tool Co, 34350 Solon Rd, Solon, Ohio

MORE DATA? Circle 56, inside back cover

Hydraulic Tracer Control Unit Adapts to Standard Lathes

Almost any standard lathe can be converted into a production tracer to handle both ferrous and non-ferrous workpieces ranging from simple axle shafts to complex configurations with a tracer control conversion unit that can be used on either horizontal or vertical machines.

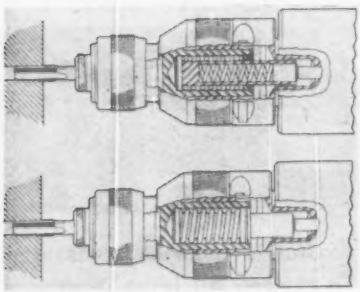
Hydraulic system makes possible

an accuracy of repetitive motion, tracing, positioning within 0.0002 in. Unit is designed to control both carriage and cross-slide from a single tracer valve. This feature, plus the fact that the cross-slide is always at full 90° to the machine's spindle axis, enables a converted machine to generate any contour—concave radii, re-entrant angles, square shoulders, chamfers, and acute angles—in addition to performing facing, straight, inside and outside diameter turning operations. Surface finishes obtained are on the order of 63 micro-in. or less, depending on the feed, material, and tool condition. Changeover from one similar job to another takes only the few minutes required to change templets.

Conversion process only requires stripping the machine down and removing the lead-screw and gearbox assembly to add the tracer control unit. Service age is no factor as long as spindle and tailstock are accurate.

Detroit Broach & Machine Co, Rochester, Mich

MORE DATA? Circle 57, inside back cover



Tap-Leader Compensates For Leads That Don't Match Tap

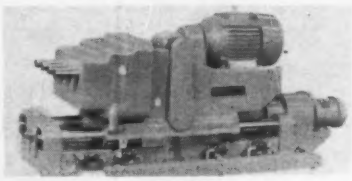
The Davis tap-leader automatically compensates for feed less or more than the tap lead on vertical or horizontal spindle machines. A sliding-adapter-sleeve-and-spring arrangement either compresses to take up excess feed (bottom) or stretches to allow for too-slow feed (top).

The tool is available in two standard models, No. 12 and 13, and will handle taps from ¼ to 1¼ in. dia. Depending on the size of the tap used, maximum depths of full thread range up to 2 in. Special tools for greater capacity than that given on the standard models will be quoted on request.

A float lock plunger converts the tools to rigid drill holders. This can be pushed and reset by the operator easily. Models 12 and 13 also feature quick-change collets that are interchangeable with those used on the company's automatic torque-setting and drilling heads.

Davis Div, Giddings & Lewis Machine Tool Co, Fond Du Lac, Wisc

MORE DATA? Circle 58, inside back cover



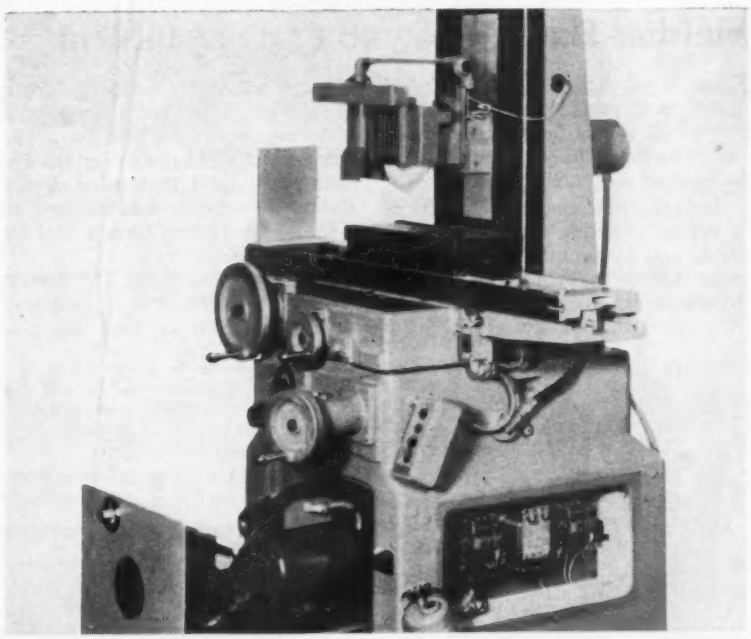
Leadscrew Unit Head Can Feed to Positive Stop

Positive - feed electromechanical leadscrew unit for drilling, boring, reaming, counterboring, spotfacing, chamfering, milling, and trepanning is claimed to be the only mechanical-drive unit designed to feed against a positive stop and provide adjustable tool dwell.

Spindle-drive, rapid-traverse, and feed are provided by separate motors. The rapid-traverse motor drives the leadscrew; the feed motor drives a recirculating-ball nut. An adjustable-torque brake permits feeding against a positive stop through controlled slip. The brake can be calibrated to slip at a preset overload, guarding machine, tools, and workpiece against damage. Standard rapid-traverse rate is 280 ipm. Unit is available in several standard capacities.

Foote-Burt Co, Cleveland 8, Ohio

MORE DATA? Circle 59, inside back cover



Reid Hydraulic Surface Grinder Switches From Hand to Power Feed Without Stopping

This new all hydraulic surface grinder has its entire hydraulic package contained in a pull-out drawer for easy maintenance. Hydraulic power pack has electric controls and a double pump that provides separate hydraulic circuits for the table and cross s'ide motions.

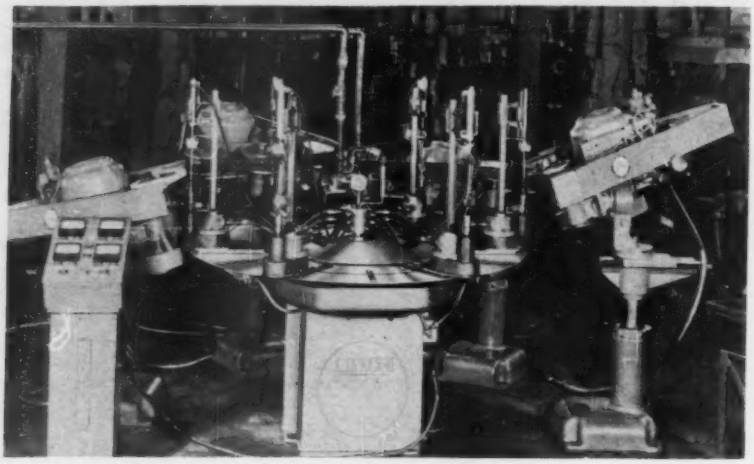
An operator can switch from power to hand feed and back instantly with the flick of a lever on the machine and he can also change to any combination of hand and power to the cross feed and table without stopping the grinder. An electro-hydraulic pilot valve control eliminates the usual to need to disconnect a table cylinder when making changes.

Operation and maintenance of the grinder are further simplified by special dust cleanout ports in back of the table, a sight-gage hydraulic tank, two-speed rapid traverse cross slide for fast wheel dressing and finger tip controls.

Tab'e speed of this model is variable to 125 fpm.

Reid Bros Co, Beverly, Mass

MORE DATA? Circle 60, inside back cover



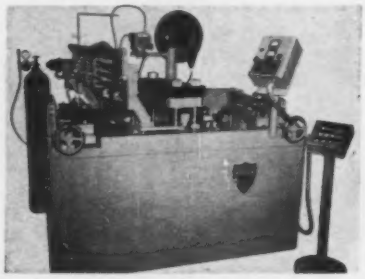
Divine Automatic Polishing Machine Finishes Flat, Contoured Parts at 1000/hr

Capable of finishing as many as 1,000 small parts or tools an hour, the RJ4X rotary automatic contour polishing machine can work with flat as well as contoured parts.

Basically the machine consists of a special indexing rotary dial conveyor and four contour abrasive belt head units. The conveyor has six hydraulically-driven fixture spindles, four working and two at loading and unloading stations. Work is carried from the loading station to each abrasive head in turn and automatically positioned for the finishing operations performed at each station. The heads also feature air control of both belt tension and the contact wheel.

Divine Bros Co, Inc, 200 Seward Ave. Utica 1, NY

MORE DATA? Circle 61, inside back cover



Automatic Shear and Welder Processes Continuous Strip

Model D4-250, an automatic combination shear and welder, provides continuous strip in any thickness from 0.040 to 0.250 in. Unit automatically aligns the trailing end of a processed coil and the leading end of the new coil, clamps both ends, shears, sets the two ends at the proper gap for arc welding, and welds the strips together with little or no increase in joint thickness over the parent metal.

Welding speeds range from 90 ipm on 0.060 thick steel to 50 ipm on 0.250. Complete time for clamping, shearing, and welding ranges from 40 to 60 sec, depending on material thickness and width. Any width from 2 to 17 in. can be processed.

Guild Metal Joining Equipment Co. 7280 Wright Ave. Bedford. Ohio

MORE DATA? Circle 62, inside back cover

Hillyer Adds N/C to Bridgeport Milling Machine At Low Cost

Low-priced numerically controled milling, drilling and boring setup combines a Hillyer Model HB-20A control system with a Bridgeport milling machine.

Controls include semiautomatic milling cycle and positioning throughout a 9 by 19-in. range. Numerical information is set into the machine by either dial or punched tape. This begins a cycle which consists of automatically positioning the spindle to designated x and y coordinates, automatic feed to depth setting, retraction, and advance to next position.

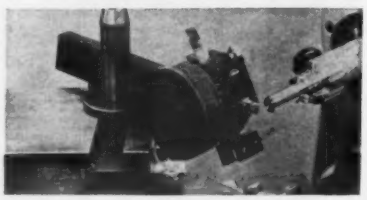
Lead screws for x and y coordinates are ground to an accuracy of 0.0005 in. per ft of length. Backlash is eliminated by approaching the final position from the same direction and feedback of the programmed drilling cycle is given to the operator by means of indicator lights on the control panel.

The spindle operates at speeds of 80, 135, 220, 330, 660, 1100, 1800, and 2720 rpm with a drilling capacity of ⅜ in. in mild steel.

Price of the complete unit without optional equipment such as tape punch, coolant system, and zeroset mechanism is $12,450.

Hillyer Corp, 244 Sheffield St, Mountinside, NJ

MORE DATA? Circle 63, inside back cover



Six-Station Toolholder Indexes To Perform All Lathe Operations

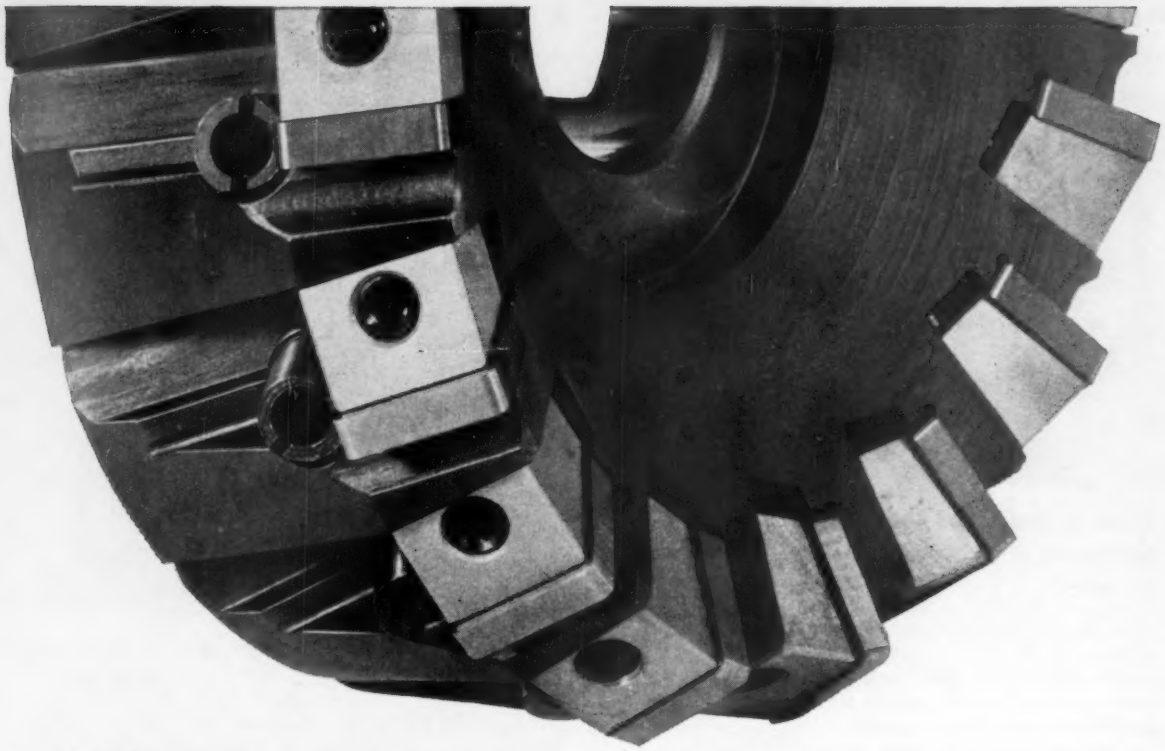
Six-station toolholder known as Turntool fits a standard toolpost on a 9 to 13-in.-swing lathe with no special installation. Facing, forming, threading, turning, boring, cutoff, grooving, and knurling can be accomplished with the tool. Indexing from one operation to the next is done by rotating the knob counterclockwise. Locking and unlocking are automatic, and the indexing action serves as a wiper to remove chips.

The tool will consistently cut from ¼ in. in drill rod to 0.0005 skin cuts in aluminum on light lathes, and will handle p'unge cutting and interrupted cuts without chatter and with a high finish resulting, according to the manufacturer.

An added feature is the use of 1-in. bits which enable operators to make 2 bits from ordinary bits.

The Frehan Co, PO Box 4007,Pasadena, Calif

MORE DATA? Circle 64, inside back cover



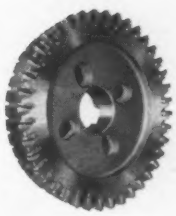
Here's the new, broader line of

V-R MILLING CUTTERS

V-R Throw-Away Insert Milling Cutters bring the economies of "throw-aways" to your milling operations — provide lowest cost per edge for all roughing, semi-finishing and finishing cuts on light, medium and heavy duty cast iron, steel and nonferrous metals.

V-R "Rigidcut" Milling Cutters, with inserted blades, are available in two basic cone-type designs — fine pitch for high speed, fast feed milling and coarse pitch for light or medium feed and speed combinations.

V-R "Varicut" Milling Cutters, with inserted blades, give you 4-way interchangeability for plain milling, full side milling, half side milling and staggered tooth milling.



Many exclusive V-R Milling Cutter features combine for outstanding production ability. V-R throw-away inserts and inserted blades are available in a wide choice of quality carbide grades. Catalogs 6103 and 6104 show the complete, new V-R Milling Cutter line. Ask your V-R man or write for your copies today.

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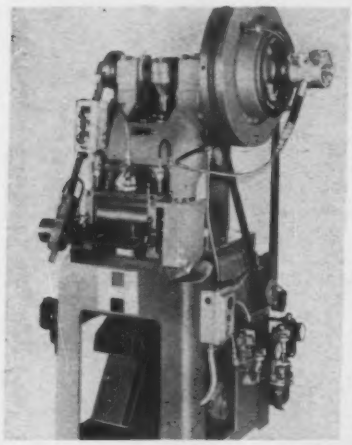


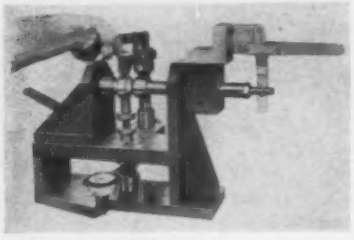
16-ton Expanded Bed Auto-Press Has Speeds of 100 to 400 spm

Extra-wide bed measurement of 11½ x 15 in. with a feed width of 8 in. makes this press suited to high production of lightweight bulky materials including plastic, rubber, and most metals. Full lubrication during high-speed operation is assured with built-in metered lubrication system. Die savings of up to 50% are made possible through cylindrical rpm design, fine parallelism, and safety shutoff, according to the manufacturer.

Crankshaft diameter is 2⅛ in. at the main bearings and 2½ in. at the crankpin. Stroke is 1 in. to 1½ in. to 2 in. For completely automatic press operation, Havir-designed Auto-Feeds are available for this model.

Havir Mfg Co, 444 N Cleveland Ave, St Paul, Minn

MORE DATA? Circle 65, inside back cover



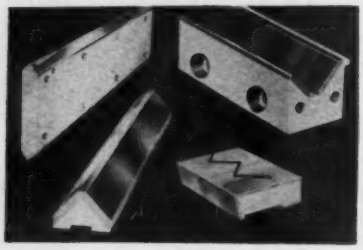
Bearing Test Apparatus Measures Radial Play

Apparatus for measuring radial play in ball, roller, and self-aligning bearings were developed by the company for use on its own Monoball self-aligning, spherical bearings. A spring pressure gage, provided to permit a constant pressure reading for each bearing, registers in increments of one tenth of a thousandth inch. Apparatus can be used on all types of bearings where there is an inner and outer race.

It checks radial play in anti-friction bearings of 5 to 38-mm bore, and other models to 153-mm bore. Unit handles self-aligning bearings in a size range from ⅛ to 1.50-in. bore and other models to 6-in. bore. It measures 14 in. long x 12 in. wide and 12½ in. high.

Southwest Products Co, 1705 S Mountain Ave, Monrovia, Calif

MORE DATA? Circle 66, inside back cover

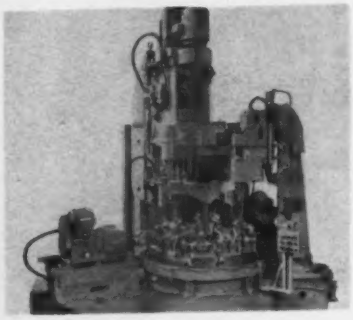


OK Way Sections Hardened Only In Areas Where Required

Initial cost savings are achieved by means of the manufacturer's special OK cladding process which makes it possible to restrict expensive hardening only to those areas of the way section where it is required. In this process, specially hardened tool steel, hardened to RH 64-660, is bonded to a soft steel backing. Installation is simplified because the backing is easily machinable and can be quickly doweled or drilled as necessary. Ways can be easily replaced or re-finished. New strips can be furnished for existing equipment, or old ones reground.

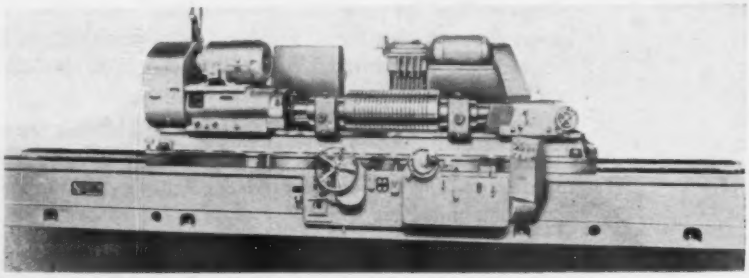
Ohio Knife Co, Dept W, Cincinnati 23, Ohio

MORE DATA? Circle 67, inside back cover



HYDRAULIC-FEED and leadscrew drilling machine for processing automotive transmissions and similar high-production parts is an 18-spindle model with a 5-position indexing table and 5-way units. It drills and taps vertical, horizontal, and angular holes. Machine finishes two complete parts at each index, 45 parts per hr at 80% efficiency—*Foote-Burt Co, Cleveland, Ohio*

MORE DATA? Circle 68, inside back cover



Norton Rod Mill Roll Form Grinder Cuts Roll Form Machining Time 20 to 25%

New 18 by 96 in. rod mill roll form grinder replaces a lathe for making rolls and will handle materials too hard to turn. Abrasive machining the rolls takes 20 to 25% less time than turning them, according to the manufacturer.

The machine mounts up to 30-in. dia 12-in.-wide grinding wheels and will turn them at 10,000 sfpm for rapid stock removal. Truing is done with a crush-truing device mounted on the wheel slide at the back of the wheel. Back-up rolls support the crushing roll during the crushing operation and eliminate the need for large-diameter crushing rolls.

Other features are: automatic wheel balancing, wheel feed mechanism for plunge grinding up to 1 in. deep on the radius, or 2 in. on the diameter, hydraulic table traverse for traverse grinding or positioning the table under power.

Norton Co, Worcester 6, Mass

MORE DATA? Circle 69, inside back cover

for KING SIZE precision gaging Starrett® long range dial indicators

With these new Starrett long range dial indicators, you can measure with continuous accuracy over ranges of up to *five inches*. Direct reading count hands and double dials let you read any dimension within the full range directly in thousandths of an inch . . . making them ideal for production measuring on boring machines and similar machine tools, as precision stops on lathes and for jig and fixture work and other long range gaging.

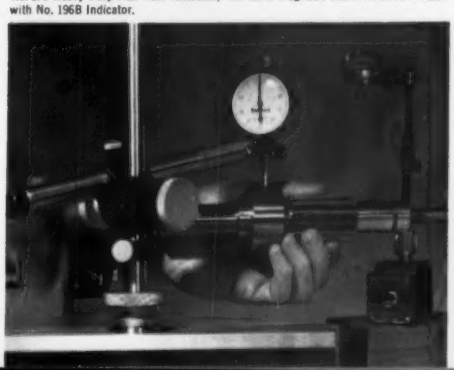
Available in 12 catalog models covering ranges of 2.000″, 3.000″, 4.000″ or 5.000″ — each in a choice of indicator dimensions conforming to A.G.D. specifications, groups 2, 3 and 4, except for range and stem length.

Your nearby Industrial Supply Distributor can supply Starrett high precision-low friction dial indicators in 144 models to meet every requirement — plus dial test indicators, dial comparators, bench gages, bore gages, portable hand gages and inside dial gages. A specialist in prompt, dependable service, he'll give you quick delivery on any of the 3500 quality products in the complete Starrett line. Write for Catalog No. 27, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

Starrett Long Range Dial Indicators. Ideal for all applications requiring extra long range up to 2, 3, 4 or 5 inches.

No. 25-106 DIAL-MASTER Super Precision Dial Indicator, No. 196 Dial Test Indicator and No. 711F LAST WORD Dial Test Indicator.

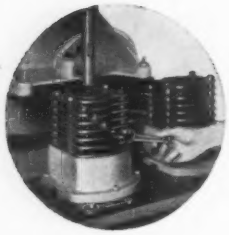
No. 675 Heavy Duty Dial Test Indicator, No. 657C Magnetic Base Indicator Holder with No. 196B Indicator.



Gaging Part on No. 653 Dial Comparator.

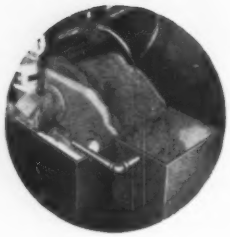
World's Greatest Toolmakers

QUALITY FOR YOUR PRODUCTS STARTS HERE



...WITH BARNESDRIL HONING MACHINES

Guarantee product quality through precision BarnesdriL Honing Machines. Greater ruggedness . . . a broader range of capacities . . . more compact design . . . easier maintenance — these are plus features inherent in every BarnesdriL machine to assure precision control at cost-cutting production rates. Our catalog 200 gives complete details. Write for your free copy!



...WITH BARNESDRIL FILTERS AND SEPARATORS

Control finish quality easily, more economically with BarnesdriL Filters, Separators, and Combination Filter-Separators. Designed to provide an abundant supply of clean, grit-free coolant, these automatic sludge removal units extend wheel life up to 50% . . . speed honing, gear-shaving and similar operations . . . cut coolant costs up to 300%. Send for catalogs 100-A and 300-D.

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Honing Machines/Production Units
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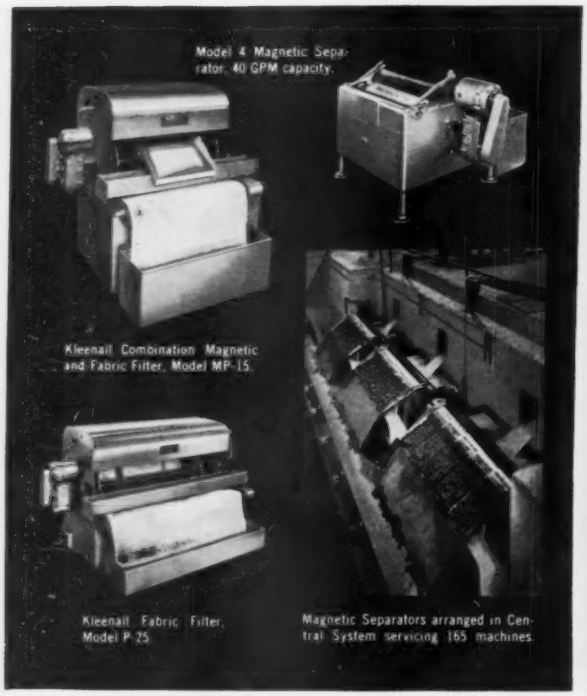
Model 4 Magnetic Separator, 40 GPM capacity.
Kleenail Combination Magnetic and Fabric Filter, Model MP-15.
Kleenail Fabric Filter, Model P-25.
Magnetic Separators arranged in Central System servicing 165 machines.

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.
Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.
Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

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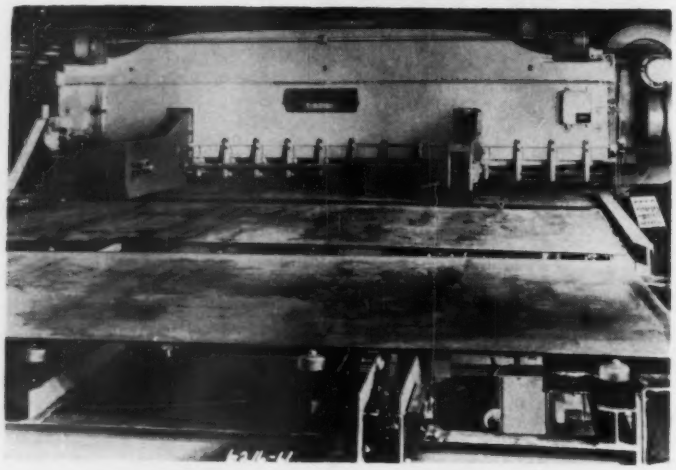
From Air to Zinc Cyanide — a CFC filter is installed on every type of industrial filtration job. Ranging from a 5 CFM FULFLO air filter to automated DELPARK coolant filters for central systems handling hundreds of pounds of sludge every hour, CFC equipment is used for every filtration operation — for air, oils, coolants and chemicals.

CFC filters are the choice of industry because they have been proven under diverse and critical operating conditions . . . because CFC has 25 years of design engineering experience in every type of filtration . . . because, from over 4311 standard models and media, plant and design engineers can be sure they will get the best filter available, at the lowest cost.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA



Cincinnati Shear With Automatic Feed Cuts ½-in. Thick, 16-ft Long Steel Plate

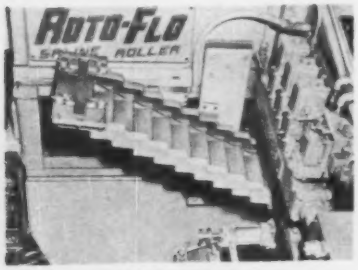
Series 6216 shear with automatic handling devices cuts steel plates to a maximum of ½ in. thickness, 8 ft wide, and 16 ft long. Material is delivered to the feed area by an overhead crane, and as it feeds through the machine, blank widths are measured with a power-operated back gage.

Sheared pieces are discharged at the rear of the machine on a conveyor and scrap separating device.

Hydraulic holddowns, ball table transfers, and pressure lubrication are other features of the shear.

The Cincinnati Shaper Co, PO Box 111 Cincinnati 11, Ohio

MORE DATA? Circle 76, inside back cover



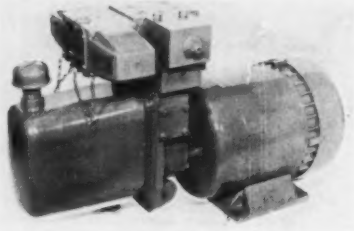
Automatic Loading Equipment Speeds Slender Parts Handling

Automatic device loads, locates, and unloads long slender parts in production machines more quickly and easily than an operator could. Blank workpieces are introduced at the top of a waterfall chute that prevents excessive rolling speed or jamming of the shafts. Shafts are slowed and straightened across the chute each time they go down a step. The chute leads to a barrel-shaped escapement mechanism that has four axial slots along its periphery. As the barrel indexes, one part enters the slot and is rotated upward 90° to the load position. The blank is picked up by live head and tailstock centers and inserted into the machine.

After the part has been processed, the head and tailstocks return it to the same slot in the barrel. Following the next index, the finished part rolls out of the barrel and slides down to a belt conveyor. All loader and machine motions can be electrically interlocked through limit switches so the complete cycle is automatic.

Gear-O-Mation Div, Michigan Tool Co, 7173 E McNichols Rd, Detroit 12, Mich

MORE DATA? Circle 77, inside back cover



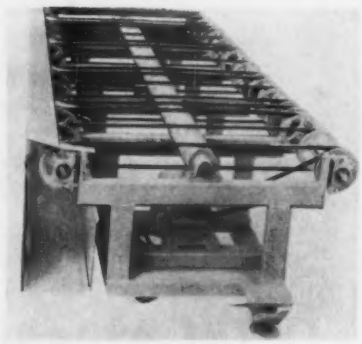
Motorized Power Packages Feature Compact Design

New motorized hydraulic power packages incorporate the pump, motor, valving, and reservoir in one compact assembly. Pump is connected directly to the electric motor's extended shaft, contributing to ease of installation. The units, with a maximum pressure rating of 1500 psi, can be used in practically any machine application.

Series PKS1, with outputs to 8 gpm, is furnished with one or two solenoid directional valves and an overload relief valve. Series PKM1, with outputs to 8 gpm, is offered with up to three manually operated directional valves and a non-adjustable overload relief valve. Series PKM6 basic models without control valves have outputs to 5 gpm. An adjustable overload relief valve is included. Electric motors are available in five sizes from 1 to 5 hp at 1800 rpm.

Vickers Inc, Detroit 32, Mich

MORE DATA? Circle 78, inside back cover



Sheet Stacker for Shears Is All-Electric Model

The AAC Shearstack for conveying sheared material to skids or into a scrap bin, is entirely electrical. The caster-equipped unit's overall depth is less than 4 ft.

The automatic scrap deflector device operates like a drawbridge; when a piece of scrap is to be handled after shearing, the operator pushes a button and the scrap deflector opens electrically, allowing scrap to fall through into a bin. At the next stroke of the shear the deflector closes automatically, permitting the following blank to pass over it on to the Shearstack for stacking. Adjustable shaft construction accommodates varying belt tensions. Heavy-duty belts are endless, with no metallic junctions to scratch blanks. Unit is positioned behind shear and operates on 115 v ac. Standard models are available for 4, 6, 8, 10, and 12-ft shears and can handle up to ⅛-in. steel or ⅜-in. aluminum.

American Actuator Corp, Box 384, Stamford, Conn

MORE DATA? Circle 79, inside back cover

AIR EXPRESS delivers parts overnight, helps cut costly inventory

This auto dealer had thousands of dollars tied up in inventory. Then he found out how quickly and easily he could get parts direct from the manufacturer by AIR EXPRESS. So now he lets the factory carry most of his inventory, and he banks the savings. AIR EXPRESS service enables you to streamline your inventory. Why stock a warehouse when AIR EXPRESS will deliver the goods at jet speed — very often the same day? Throughout the U. S. and Canada, 35 scheduled airlines and 13,000 trucks give your shipments first on—first off—first there priority, with kid-glove handling all the way. Just mark your orders "AIR EXPRESS"

AIR EXPRESS

CALL YOUR LOCAL R E A EXPRESS OFFICE FOR AIR EXPRESS SERVICE

CIRCLE 352 READER SERVICE CARD

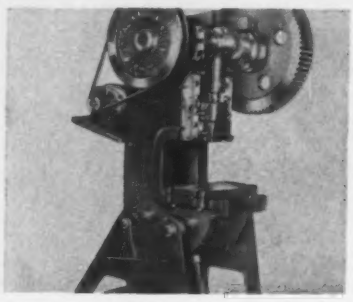
Turret Indexing Machine Chassis Engineered for Light Assembling

Series SD, a companion machine to the company's Series MD (*AM/MM*—Apr 4 '60, p194), is especially designed for high-speed, comparatively light, sequential assembling and processing operations and is offered in a wide range of turret diameters, index positions, and work cycles.

Utilizing the dual motion method of multiple piece-part assembly, the self-contained chassis offers advantages which include positive parts control, reduced jamming potential, design simplicity, tooling accessibility, and tool standardization.

Swanson-Erie Corp, 816 E Eighth St, Erie, Pa

MORE DATA? Circle 80, inside back cover

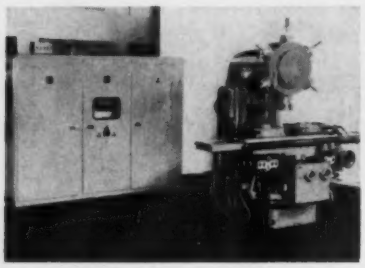


Alva Allen Offers Line of Back Geared Presses From 2 to 25 Tons

Complete line of back geared punch presses ranges in capacity from 2 through 25 tons (25-ton model shown). The presses are said to give slow powerful strokes and can be easily changed from repeat to non-repeat action. With this type of press strokes per minute or flywheel rpm can be reduced as desired without sacrificing press tonnage capacity. Standard strokes per minute is 100 on all models. Other specifications include: stroke length (max) from ¾ in. on the 2-ton press up to 4 in. on the ilustrated 25-ton press, and die bed area of 8 by 6¼ in. on the smallest press to 12 by 21 in. on the largest.

Alva Allen Industries, 1001-15 N 3rd St, Clinton, Mo

MORE DATA? Circle 81, inside back cover



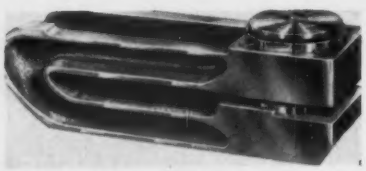
Vertical Tape-Controlled Milling Machine Also Does Drilling, Boring

Werner tape controlled vertical milling machine with a hexagon turret for milling, drilling, and boring has an analogue feedback system. In this system, the position of the table is reported in the form of a variable voltage to the control cabinet and compared with the input data. The moment the two values coincide, a special circuit operates a relay and brings the table to a standstill.

Principle dimensions of the machine are: Table size, 53 by 14 in.; longitudinal feed, 39½ in.; transverse feed, 11 in.; vertical feed, 17 in.; distance, spindle face to table, 1¼ to 22 in. All feeds are automatic. Longitudinal and transverse feeds operate at 1¼ to 40 ipm, vertical feed operates at ¼ to 8 ipm.

Dist by Marac Machinery Corp, 104 Grand St, White Plains, NY

MORE DATA? Circle 82, inside back cover

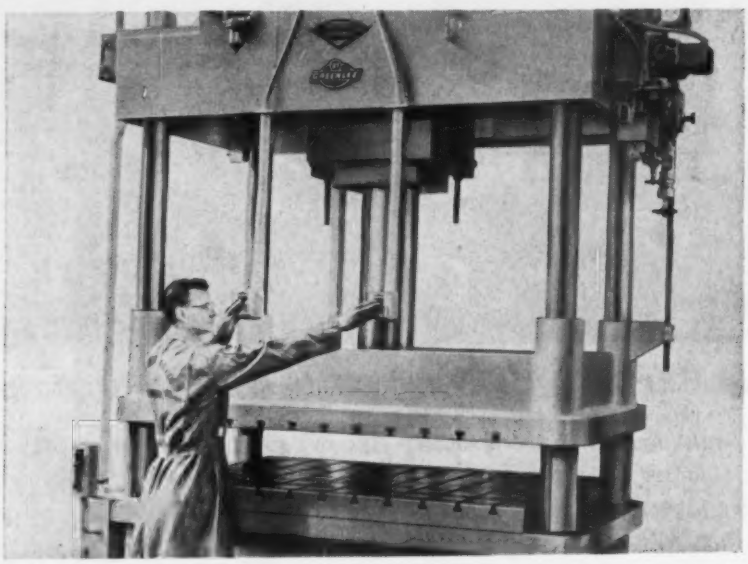


TPC Hole Punching Units Punch Up to 3½-in.-dia Holes

New series of regular duty 5½-in. hole punching units increases the range of holes punched to a maximum of 3½-in. diameter. (The 5½-in. designation is the width of the C frame). Units perforate a maximum metal thickness of ⅛ in. in mild steel. They are available with 8, 12, and 16-in. throat depths and are interchangeable or compatible with other makes of unitized tooling.

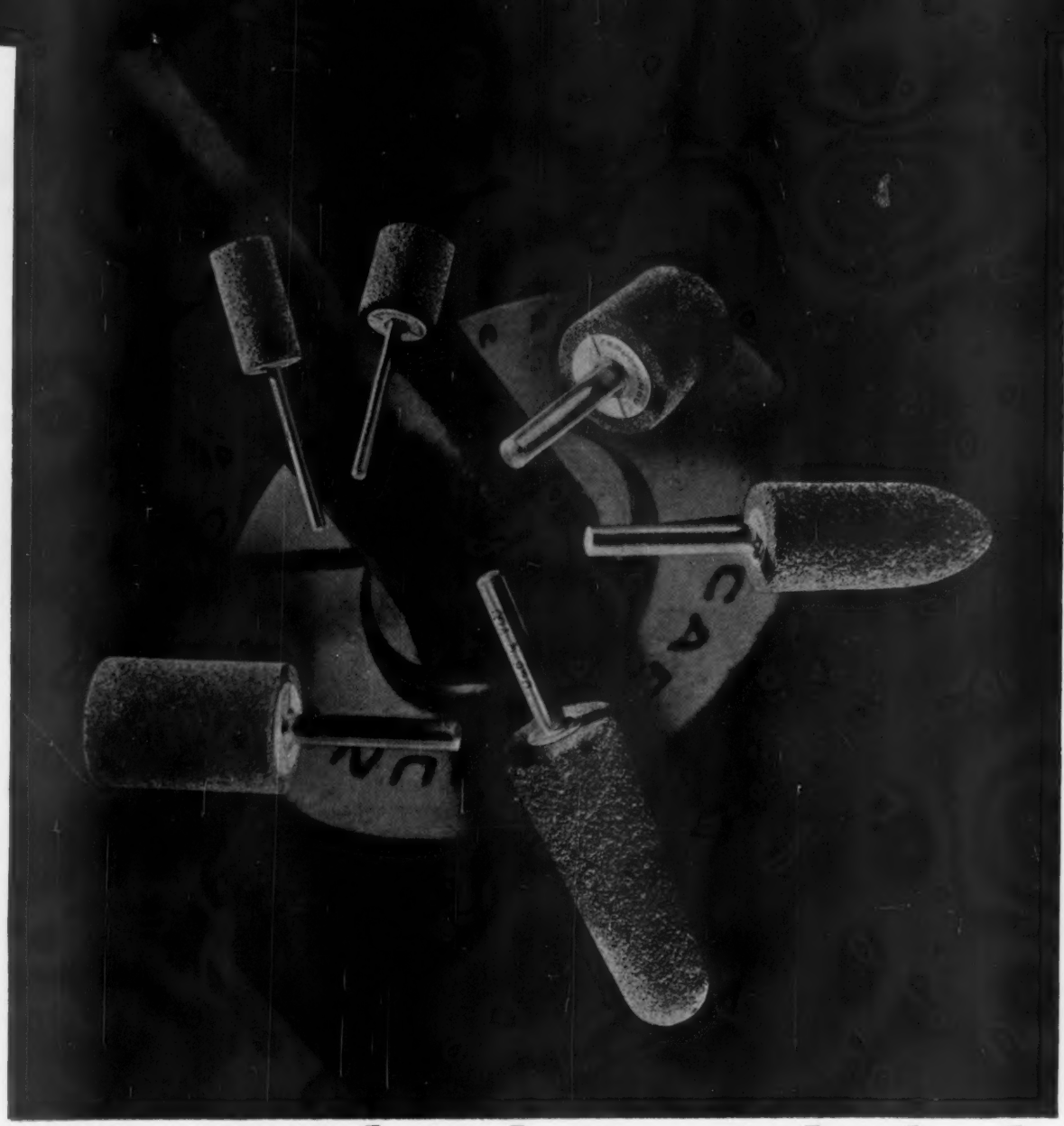
Tool Products Corp, N Tonawanda, NY

MORE DATA? Circle 83, inside back cover



4-BAR TRIM PRESS, equipped with an adjustable deceleration valve, exerts 100 tons of trimming stroke pressure. High-speed production is possible because of fast approach velocity of 900 ipm and return speed of 875 ipm. Slow trimming action of 59 ipm produces neatly sheared castings. Additional features include a 36 x 72-in. die area; supporting 52 x 88-in. base platen; safety stops on tiebars; and 30-in. stroke—*B & T Machinery Co, Holland, Mich*

MORE DATA? Circle 84, inside back cover



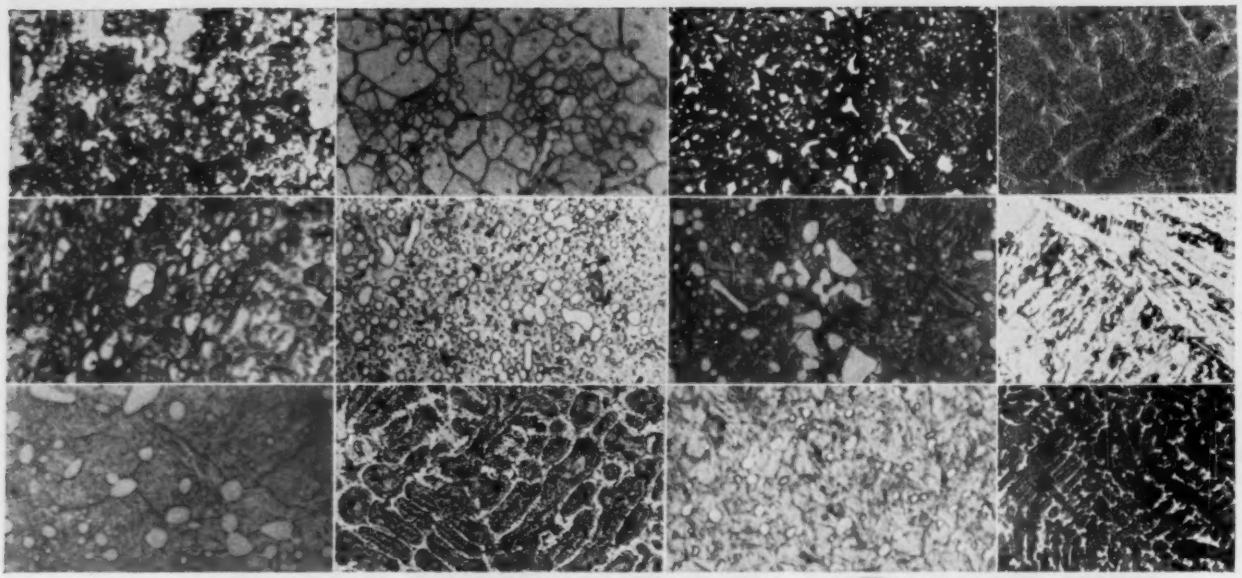
NEW... Metal-Lock Mounted Wheels

... extra strength for trouble-free portable grinding

Mandrel failure, wheel breakage and fly-off is reduced to a minimum with Carborundum's new Metal-Lock Mounted Wheels. With mandrels actually metal-fused to the abrasive, the Metal-Lock Mounted Wheels withstand extreme heat and vibration on the roughest of grinds. The abrasive can be used effectively right down to the mandrel. Clean, even metal mounting also assures precise balance in every wheel. Carborundum's Metal-Lock Wheels are identified by the new red and white blotter... call your Carborundum distributor for a demonstration. Bonded Abrasives Division, Niagara Falls, N. Y. **CARBORUNDUM**

METAL-LOCK MOUNTING. Die-cast metal in molten stage is injected into wheel under pressure, fusing it to the abrasive grain (circle) to produce this new more durable mandrel bond.

TORTURE TEST PROVES STRENGTH. Metal-Lock Mounted Wheels were subjected to a series of torque stress tests in Carborundum Laboratories. In each test, at point of maximum stress, the ¼" stainless steel mandrels snapped off before there was any evidence of yielding between mandrel bond and wheel.

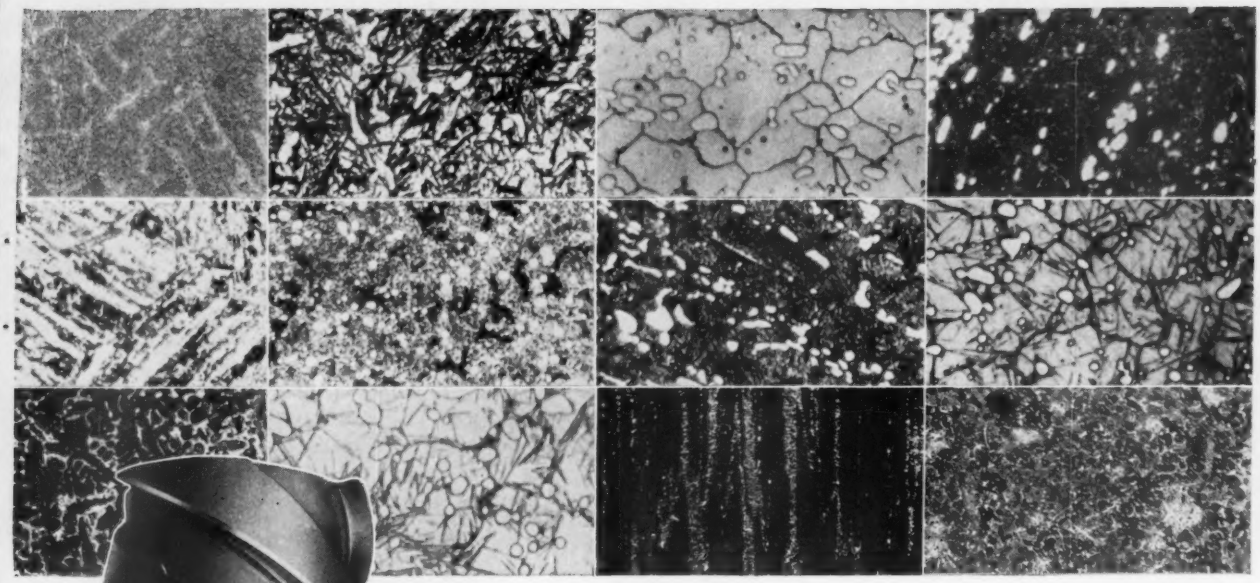


WHICH STEEL

■ It's a good idea to buy cutters from a company that knows

MAKES THE BEST CUTTER?

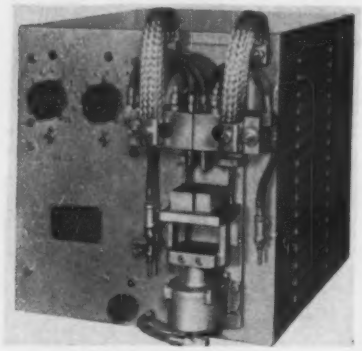
the answer to this question. These high-speed steels, only a few of those submitted to us each year by the mills, were rejected in our metallurgical department. None of them has the right combination of red-hardness properties, toughness, wear-resistance, hardenability, and stability under heat treatment. Every Barber-Colman cutter, no matter what the size or price, is made from mill-selected tool steels which meet our own metallurgical standards. Every cutter starts in our shop with a complete metallurgical check–not only to determine correctness of ma-



terial, but also to provide data to be used by our engineers and toolmakers in producing the finest possible tools from that material. ■ Look-alike cutters can be miles apart in quality. Your best test is total COST-PER-PIECE, and your best bet is Barber-Colman quality. (Complete range of standard cutters for off-the-shelf delivery.) Ask your Barber-Colman representative for a copy of the hard-cover MILLING CUTTER HANDBOOK – 219 pages of useful information on selection, use, and care of milling cutters. NOTE: Your special cutters receive individual material analysis, selection, and heat treatment if you specify type and hardness of metal to be machined.

BARBER COLMAN

BARBER-COLMAN COMPANY 101 LOOMIS STREET, ROCKFORD, ILLINOIS



Power Pack Developed for Multiple Spot Welding

Model 60-T, composed of two or more dependent high-output water-cooled transformers, offers single-cycle operation of one or more spots in rapid sequence. It is said to be particularly suited for high-output automatic feed units.

The air-actuated timing controls have 100-amp contactors and can operate the transformers in single sequence or in pairs. Build-up of welding tip pressure triggers the first timer, which in turn triggers the second one. Power supply required is 220-250 v, 60 c, single phase; maximum output is 10 kva per transformer. Unit is equipped with a heavy-duty aluminum front panel.

Ampower Products, 10207 S Ridgeland Ave, Chicago Ridge, Ill

MORE DATA? Circle 100, inside back cover

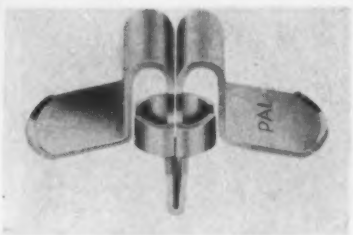
Elevating Feed Table Doubles As Transport Truck

Model 600 Steelmobile Senior is a mechanical combination sheet and plate elevating feed table and transport truck for use with punch-presses, shears, and similar equipment.

Constructed with solid steel plate top, operated by a heavy-duty scissors mechanism with ball bearing screw drive, it is powered by a ¾-hp 220/440-v 3-phase right angle gear motor with brake. Entire truck is mounted on four steel swivel casters equipped with swivel locks enabling either end to trail; it will tow from either end under full load. Unit is rated at 6000-lb capacity with choice of two top sizes, 36 x 96 in., or 36 x 120 in. It elevates from 20 in. low to 36 in. high and is equipped with pedal control at end of a 15-ft cable or pushbutton control on side of top.

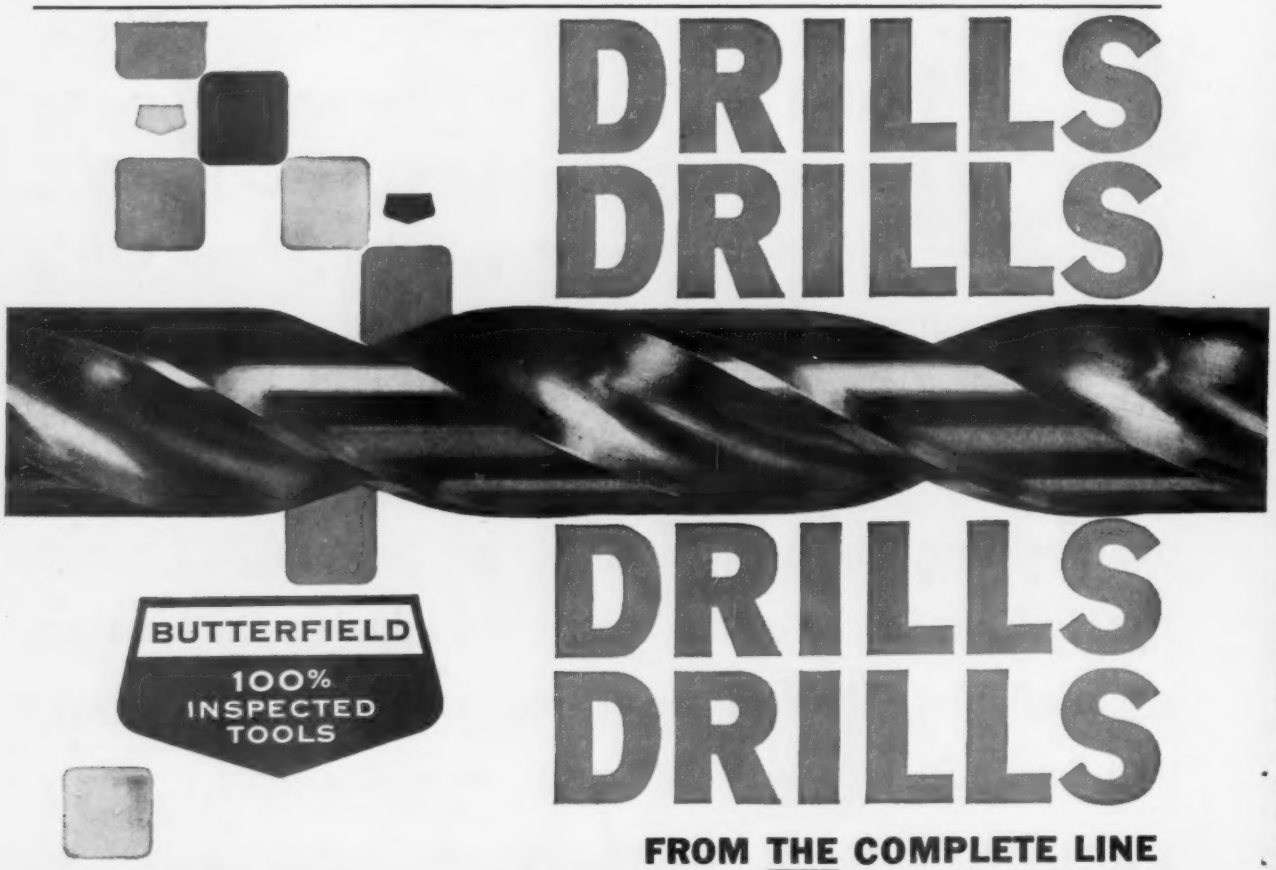
Jarke Mfg Co, 6333 Howard St, Chicago 48, Ill

MORE DATA? Circle 101, inside back cover



Quarter-Turn Fasteners Offered For Light-Duty Applications

One-piece, lightweight spring steel fasteners are furnished in two types; both feature a barrel shank to keep

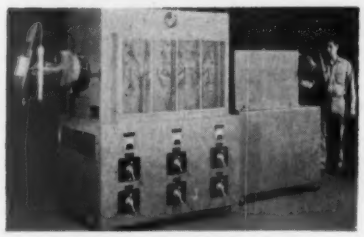


them centered in hole and to add shear resistance.

Part No. QA50080 is designed for easy finger assembly and is locked and unlocked by pressing firmly with fingers and rotating 90° either direction. Part No. Z0001529 is assembled by pushing into panel holes, then inserting screwdriver into fastener slot, depressing arched head and rotating 90°. This fastener provides an almost-flush surface.

Palnut Co, Div of United-Carr Fastener Corp, 61 Glen Rd, Mountainside, NJ

MORE DATA? Circle 102, inside back cover



Zoned Tube Furnaces Feature Interchangeable Components

Muffles, entrance (or purge) chambers, water cooled sections, and other optional features can be removed or replaced to meet changing requirements in redesigned Harper line. Both air and controlled atmosphere models are available in heated lengths from 2 to 4 ft with 3, 4, or 5-in. ID muffles for firing, calcining, sintering, brazing, annealing, oxidizing, and general heat treating.

Three zones of temperature control in the heating chamber make it possible for end zone temperatures to be raised, compensating for end losses; length of temperature uniformity is increased as a result. Tubular muffles are furnished in high temperature porcelain (for temps up to 2750 F) or alloy (for temps up to 2300 F).

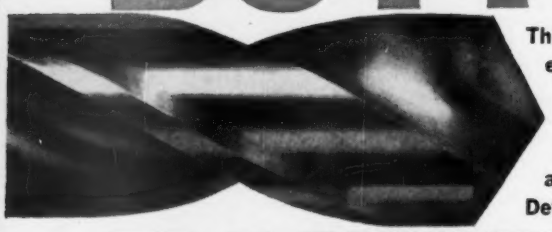
Harper Electric Furnace Corp, 110 Pearl St, Buffalo 2, NY

MORE DATA? Circle 103, inside back cover

LO-DIE TUBE END FINISHER (developed by Lordstown Tool & Die Co, in cooperation with Behr-Manning) deburrs cutoff ends of rectangular and circular steel tubing. Machine is automatic except for loading and unloading. Ragged ends of tubes are cut off by two 20-in. resinoid-bonded wheels using 60-grit aluminum oxide. For deburring, the tube sections pass between eight Vonnegut heads (at rate of seven to nine pieces per minute) loaded with 80-grit aluminum oxide abrasive cloth. Heads are rotated at 1200 rpm and are angled to produce the most effective deburring action on both inner and outer surfaces—*Behr-Manning Co, Troy NY*

MORE DATA? Circle 104, inside back cover

BUTTERFIELD
BUTTERFIELD



The outstanding performance and tool life of Butterfield drills are engineered into the complete Butterfield line — for best results when any cutting tool is used alone, and for smooth teamwork in multiple tool machining. Whatever you machine, wherever you're located, get these advantages, backed by fast deliveries and expert technical aid . . . Call your Butterfield Distributor. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

BUTTERFIELD
BUTTERFIELD

Division, Union Twist Drill Company, Derby Line, Vt.

Why hammer the spindle of a Hamilton Gage?

To prove that Hamilton Gages are built to take it. (You can drop a Hamilton Gage on its spindle and it still maintains its accuracy.) The reason: a unique, indirect transmission action from spindle to gear mechanism. Pressure at the spindle end *releases* the movement for operation rather than driving it. As a result, any shock at this point cannot force the gear mechanism . . . and *you* cut replacement costs.

More reasons why you can depend on Hamilton Gages? Hamilton's offer of a complete movement replacement for a nominal charge. Hamilton's gage repeatability to .00001". Hamilton's light gaging force (2 or 4 ounce) that's adjustable. Hamilton's years of watchmaking experience, so valuable in maintaining the fine accuracy of precision gages. Hamilton's complete line of mechanical and electric gages for post-process inspection or in-process production control.

For free data sheets on Hamilton Gages, write to Dept. 2210, Hamilton Watch Co., Lancaster, Pa. They give full specifications on most items in our line. Or, if you have a special gaging problem, write directly to E. P. Barber, Director of Industrial Products Division.

Kwik-Chek Gages—another precision product of the

HAMILTON WATCH COMPANY

Industrial Products Division, Lancaster, Penna.

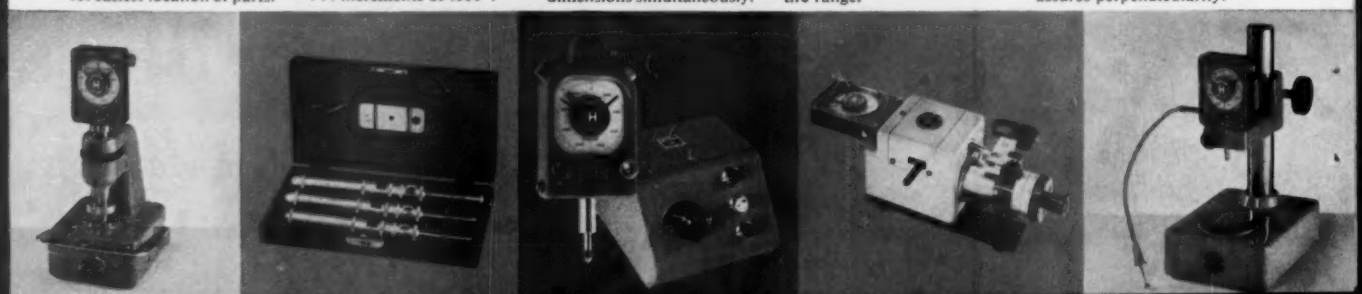
HAMILTON RECESS DEPTH GAGE for production gaging of recesses. Comes with both tiltable and rigid table for easiest location of parts.

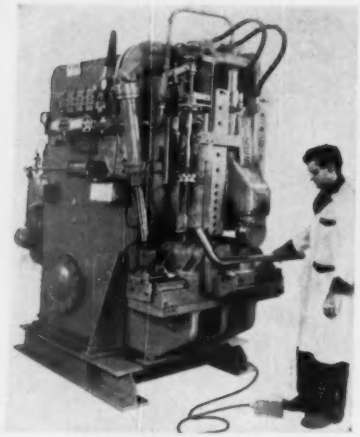
HAMILTON HOLE GAGES replace as many as 700 plug gages. Precision accuracy in range from .025" to .380" . . . increments of .001".

HAMILTON ELECTRIC GAGING SYSTEMS for in-process control. Lights indicate several out-of-tolerance dimensions simultaneously.

HAMILTON HORIZONTAL INDICATING MICROMETER GAGE for absolute measurements. Accurate to .00005" over entire range.

HAMILTON PRECISION DIAL COMPARATOR for applications requiring ultimate in precision. Fine adjustment assures perpendicularity.





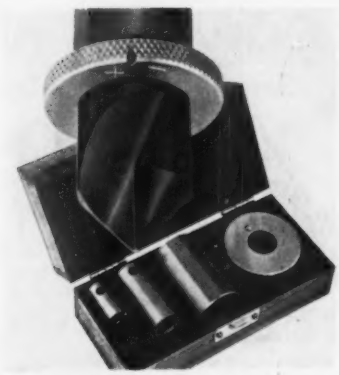
Pines 30- and 40-Ton Presses Produce up to 800 Bends an Hr

Models 30T and 40T bending presses are 30 and 40 ton capacity models respectively for working tubing and pipe in sizes up to 3 in. OD on the smaller press, 4 in. OD on larger.

Both machines are powered by 20 hp motors and pumps which produce enough force to bend laminated tubing or heavy-wall boiler tubing. Production speeds are said to be up to 800 bends an hour. Bend angles are automatically controlled by an indexing 10-position selector that automatically returns to starting position after a preselected number of bends. Stop pins are easily adjusted to produce any angle up to 165 degrees and are interchangeable with pre-set pins for quick setups.

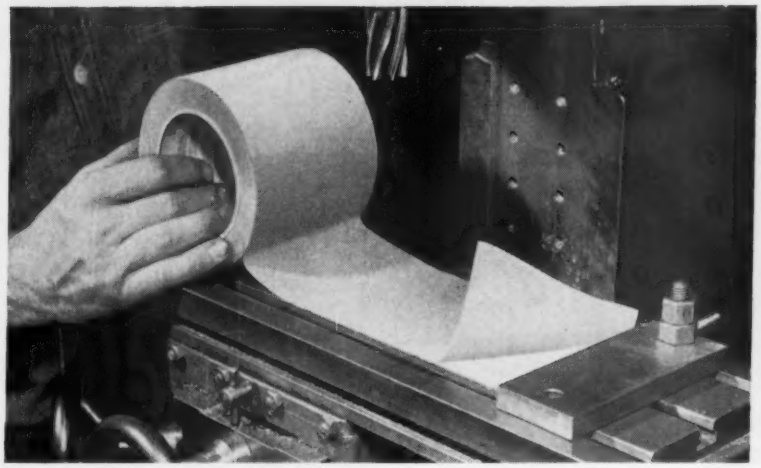
Pines Engineering Co, Inc, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 105, inside back cover

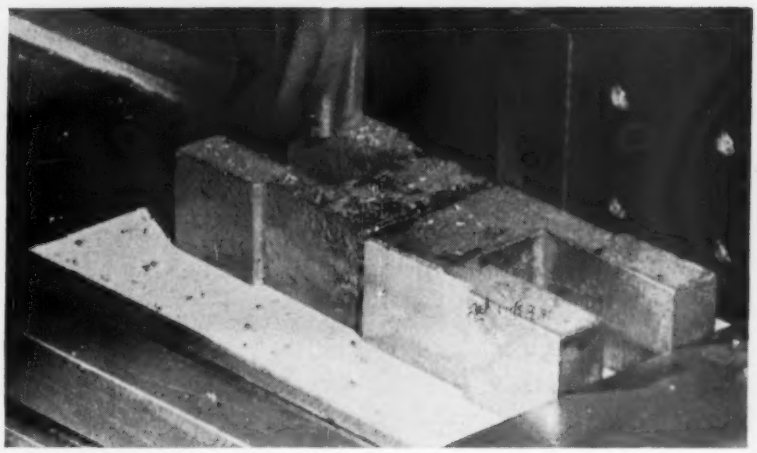


UNICAM RESHARPENING FIXTURE for Ford Uniflute countersinks can be adapted to any toolroom grinding equipment. Packaged assembly includes box, cam body, locating ring, adapter sleeves, and key. Price is $30 *—M A Ford Mfg Co, 1545 Rockingham Rd, Davenport, Iowa*

MORE DATA? Circle 106, inside back cover



holds any metal like a magnet!



lock down nonferrous metals for milling with double-coated

TAPES FROM 3M

Keep nonferrous or small, hard-to-clamp parts where you want them during machining and finishing operations. "Scotch" Brand Double-Coated Tape goes on quickly . . . holds tight even under a flood of cutting fluid. This "tape that sticks on both sides" speeds such operations as cutting, grinding, milling and polishing.

TRY THIS METHOD. Ask your nearest "Scotch" Brand Tape Distributor to demonstrate this and the many other "Scotch" Brand Tapes for masking, surface protection, and metal finishing. Or, write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-101

SCOTCH BRAND tapes for industry

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

To Achieve the Optimum in Tool Design... the Ultimate in Performance...

Typical of the continuing forward progress in manufacturing techniques which has characterized its service to the metalworking industry, National Tool offers a facility to provide the ultimate in accuracy and speed.

Introduction of the Bendix G-15 Digital Computer into its tool engineering system obtains by electronic computation a complete analysis of part and tool elements . . . attaining the highest levels of speed and accuracy. Accomplishing what formerly required hours or even weeks of manual calculation, completely validated results are possible in a matter of minutes.

Optimum tool design, development of absolute specifications to micro-measurements for mating parts, accuracy and tolerance factors hitherto impossible . . . these are among the many production benefits that lead to longer, more efficient tool life.

NATIONAL Tools CLEVELAND

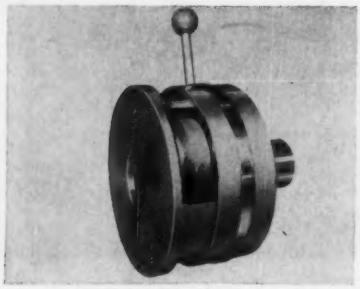
NATIONAL TOOL COMPANY
A Division of
National Cleveland Corporation
11200 Madison Avenue Cleveland, Ohio

For more than a half century National Tool has supplied high quality precision cutting tools to the metalworking industry.

For your special cutting tool requirements call your National Tool representative.

Versatile, flexible, and with unlimited application range, data can be fed into the Computer for single or repeat solutions . . . memory stored and automatically available.

CIRCLE 340 READER SERVICE CARD

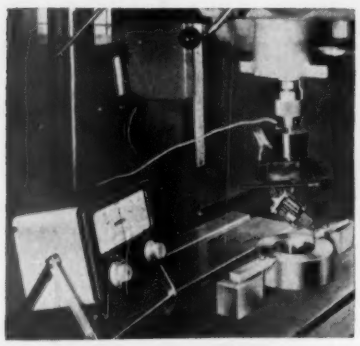


2-in. Thread Rolling Head Added to Landis Line

No. 16 head, available in both stationary and revolving models, is designed to thread roll diameters from 1¼ to 2 in. UNF and UNC (RH and LH). Both styles are self-opening in operation. The stationary head is opened by interrupting the forward travel of the turret or carriage, while the revolving head is opened by interrupting the forward travel of the yoke. Closing of the stationary head is by a reset handle; revolving head is closed by a yoke.

Landis Machine Co, Waynesboro, Pa

MORE DATA? Circle 107, inside back cover



Transistorized Centering Gage Gives 5500 to 1 Magnification

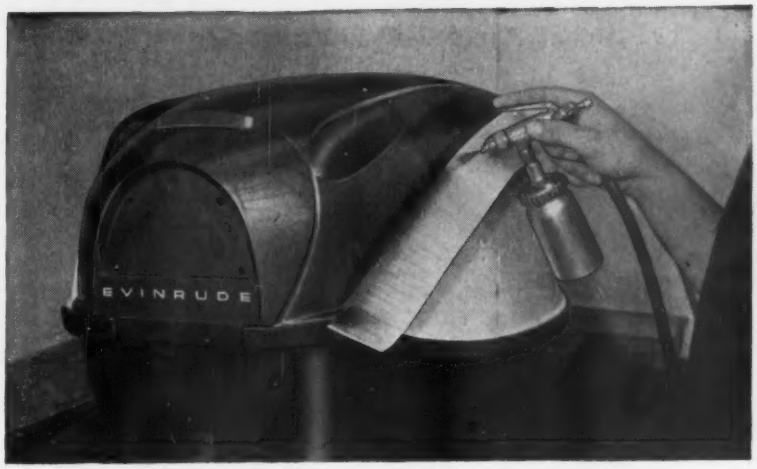
This gage for centering holes or cylindrical forms under machine spindles has a highest magnification of 5500 to 1 with graduations of 0.000020 in.

A rotary connector allows the gage head to rotate freely with the spindle while the cable to the amplifier remains stationary. This connector is adjustable to accommodate radii up to 9½ in. Gaging pressure of less than 2½ grams eliminates deflection of the spindle.

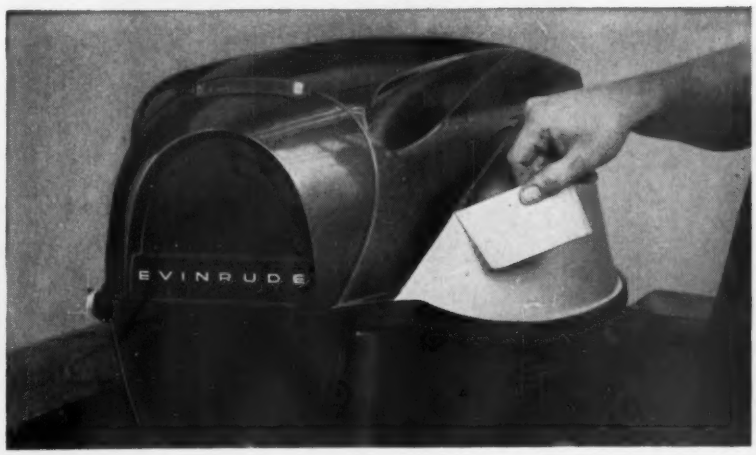
The amplifier is transistorized and battery-powered for instant operation and portability.

Federal Products Corp, Providence 1, RI

MORE DATA? Circle 108, inside back cover



final touch-up
fast and clean!



fine-line separations between colors made sharp with masking

TAPES FROM 3M

The final touch of quality for Evinrude outboard motors goes on easily and quickly with the help of masking tapes from 3M. After motor shrouds are covered with flexible shields and sprayed, separation between colors is ragged. Application of "Scotch" Brand Masking Tape and a quick final touch-up spray makes the separation sharp and clean.

TRY THIS METHOD. See how it speeds finishing operations and improves results. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. IBA-101

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tapes for industry

Minnesota Mining and Manufacturing Company
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3M COMPANY

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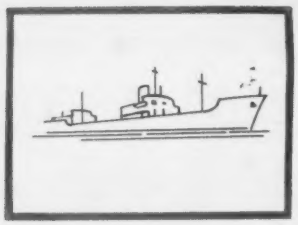

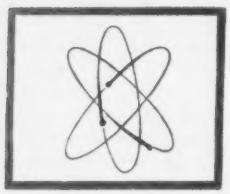

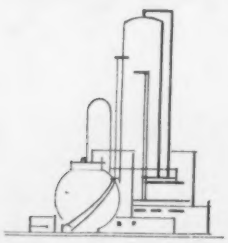

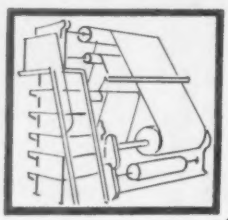

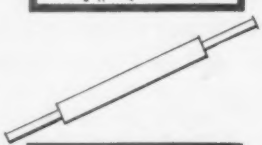

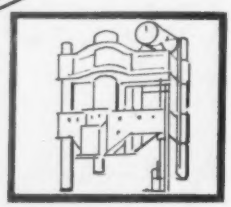

CHECK ACIPCO'S UNIQUE ADVANTAGES

Greater versatility in design . . . new concepts in economy . . . these are some of the unique advantages you get with ACIPCO CERAM-SPUN*, the new ceramic mold process. Now, for the first time, you can order the exact size plain carbon or alloy steel, cast iron or alloy iron tube you need . . . and save the cost of unnecessary metal waste. And, ACIPCO's complete "under one roof" facilities can also save time and money. If you design, manufacture, or use parts requiring tubular metal stock as a component, it will pay you to check ACIPCO CERAM-SPUN tubing before you buy. Contact ACIPCO STEEL PRODUCTS, Division of American Cast Iron Pipe Company., Birmingham, Alabama.

COMPLETE FACILITIES

SPINNING: ACIPCO CERAM-SPUN tubes are centrifugally spun to exacting physical and metallurgical specifications. The specific size and metal analysis your process or project requires are assured.

FABRICATION: Complete, integrated facilities for machining, welding, finishing, including honing and grinding, and heat treating of tubular parts save shipping time and expense for ACIPCO customers.

TESTING: Facilities for both hydrostatic and air testing, as well as for other physical and chemical analyses and tests, are available as part of complete ACIPCO tube service.

INSPECTION: Expert inspection, including radiography, during all phases of production, maintains high quality of ACIPCO CERAM-SPUN tubes.

TECHNICAL ASSISTANCE: A staff of highly trained engineers, metallurgists, chemists and craftsmen serves the designer and manufacturer who specify ACIPCO tubes.

SIZE RANGES: ACIPCO CERAM-SPUN tubes are produced in lengths from 4 feet to 20 feet—longer lengths are made by welding; O.D.'s from 2.25" to 50"; wall thicknesses from .25" to 8".

ANALYSES: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steels, plain carbon steel and special non-standard analyses.

FINISHES: As cast, rough machined, or finish machined, including honing and grinding. Complete welding and machine shop facilities available.

*Patent applied for.

ACIPCO CERAM-SPUN
STEEL TUBING

New Series of Impact Wrenches Available From Airetool

The 400 Series of pneumatically operated wrenches have a ¼-in. bolt capacity with a ¼-in. female hex quick change chuck, ⅜ and ½-in. drive squares. All models have a ¼-in. pipe tap, and they are furnished with either pistol grip of straight handles.

Operating on low air consumption, these lightweight tools have a high rundown speed. Impact mechanism doesn't depend on springs or centrifugal force for operation, and all are reversible in either direction.

Airetool Mfg Co, Springfield, Ohio

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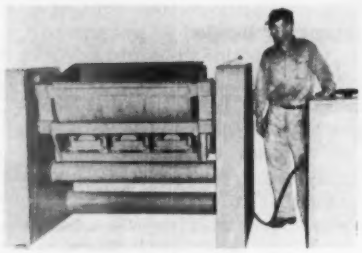

Vibratory Finishing Machine Has Shaking Forces up to 50 Gs

Vibrodyne Model V-600, a 6 cu-ft-capacity unit, uses a resonant electro-magnetic system to give shaking forces up to 50 Gs and has only one moving part—the tub. Shaking force is set by a single knob, from 0 up to 5/16-in. amplitude, and power is standard 220-v ac operating through three pairs of heavy-duty magnets impregnated and encapsulated with epoxy compound.

Suspension is such that a continuous rotary turnover motion provides 100% scrubbing action between media and parts, eliminating packing. Air-dumped tub is 37x20x15 in. deep and holds a 750-lb charge. The 2750-lb machine does not need to be bolted to the floor.

Globe Industries Inc, Vibrodyne Div, 125 Sunrise Pl, Dayton 7, Ohio

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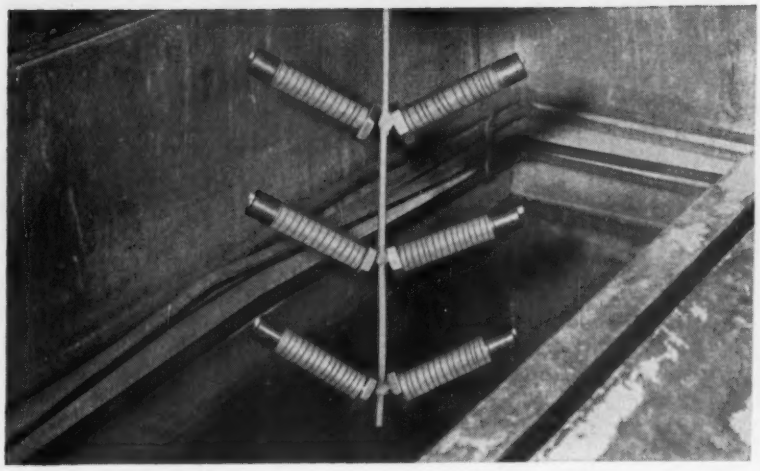

mask simple shapes or complex contours

plating solutions can't creep under these tight-sticking

TAPES FROM 3M

Stop-off masking and rack wrapping are fast, easy, sure when you choose tapes from 3M for the job. "Scotch" Brand Electroplating Tape No. 470, developed especially for plating applications, is strong, conformable and has a backing that resists effects of most solutions.

Other electroplating tapes too: one that's extremely thin, tough, transparent; another backed with lead foil for use where "thieving" action is required.

TRY THIS METHOD. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. IBA-101

SCOTCH BRAND tapes for industry

Minnesota Mining and Manufacturing Company

...where research is the key to tomorrow

3M COMPANY

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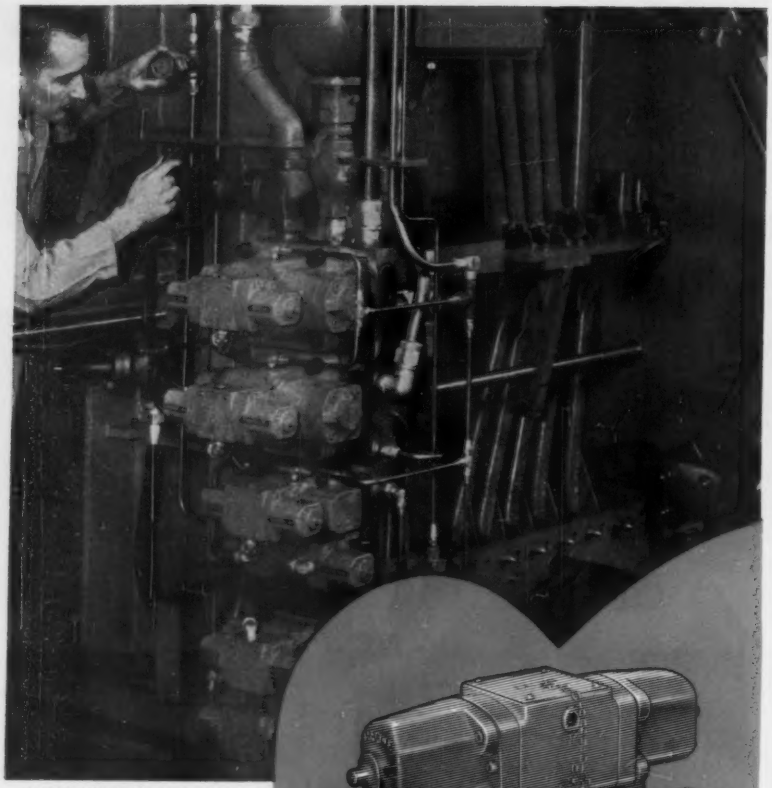
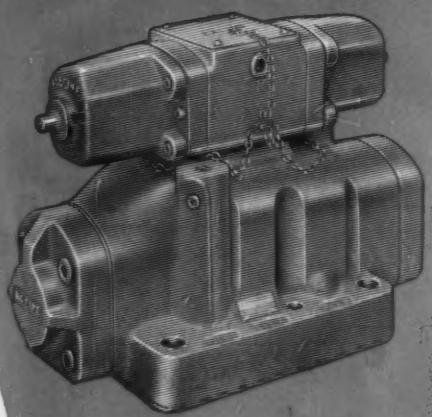


HYDRAULIC VALVE SYSTEM OF WIRE-FORMING MACHINE BUILT BY RESEARCH DESIGNING SERVICE, INC., CENTERLINE, MICHIGAN

during set-up and at 3000 springs per hour



6 RACINE

Directional Control Valves guide hydraulic wire-forming operations of this machine

RELIABLE VALVES DIRECT THE POWER OF A HYDRAULIC HEART

"Control of all our hydraulic operations is vital, and this is possible with RACINE equipment," says Bill Karolle, electrical engineer with Research Designing Service, Inc. "Our hydraulic machines are used to form wire for 80% of all automobile seat springs." As oil requirements change constantly during set-up operations, 6 RACINE DIRECTIONAL CONTROL VALVES guide the *right oil volume* at the *right pressure* to the *right place* at the *right time*. At high production speeds, these 4-way, solenoid-controlled valves maintain the pre-set wire forming pattern with absolutely uniform precision. Valve reliability is important since these machines may perform over five million cycles during their lifetime.

RACINE

Racine Hydraulics & Machinery, Inc.

RACINE, WISCONSIN

HYDRAULICS DIVISION

Multi-Hole Driller Duplicates 4000 Holes/hr From Template

Up to 4000 holes per hour can be drilled by this Panto-Duplicator which operates in conjunction with a template and a pantograph. The pantograph has a stylus that is moved from hole to hole in a template. This stylus controls the drill so that when it is fully seated in a hole on the template, the workpiece is drilled. A limit switch on the stylus protects the workpiece against drilling until exact duplication is assured.

The machine is equipped with a built-in vacuum exhaust system that keeps work free of chips and shavings and double bushing action assures clean burr-free holes.

Coleman Machine Co, Inc, 321 Snyder Ave, Berkeley Heights, NJ

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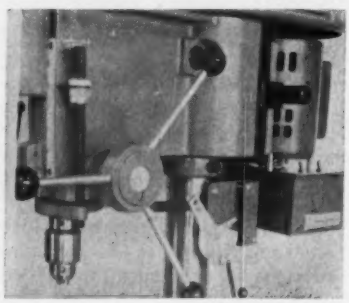

Attachment Converts Standard Drillpress to Automatic Tapping

This attachment converts any standard drillpress into an automatic tapping machine that will handle any thread from 0-80 to ½-in.—13. The unit will cut either right- or left-handed threads to any pre-set depth and will auomatically reverse direction and return the chuck to its

original position. Attachment comes complete with reversible motor, control cam, limit switch linkage and instructions.

Precision Specialties, Inc, Pitman, NJ

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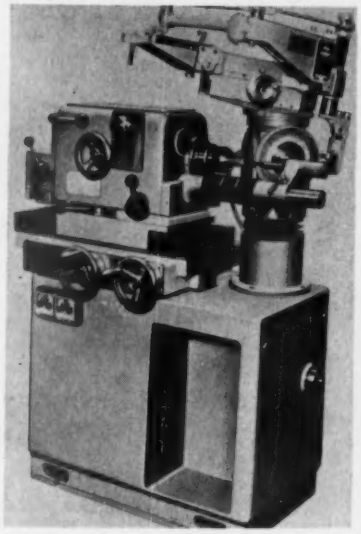


Grinder Sharpens Axial, Radial Relief Angles Simultaneously

This fully automatic grinder simultaneously grinds and sharpens the axial and relief angles of all step tools.

Manufactured by Rhode & Doerrenberg, Dusseldorf, the machine will also grind cylindrical diameters and flats.

Multi-step tools are held between centers, in a No. 2, 3, or 4 Morse taper-bore headstock spindle, or in collets with either cylindrical or tapered holes.

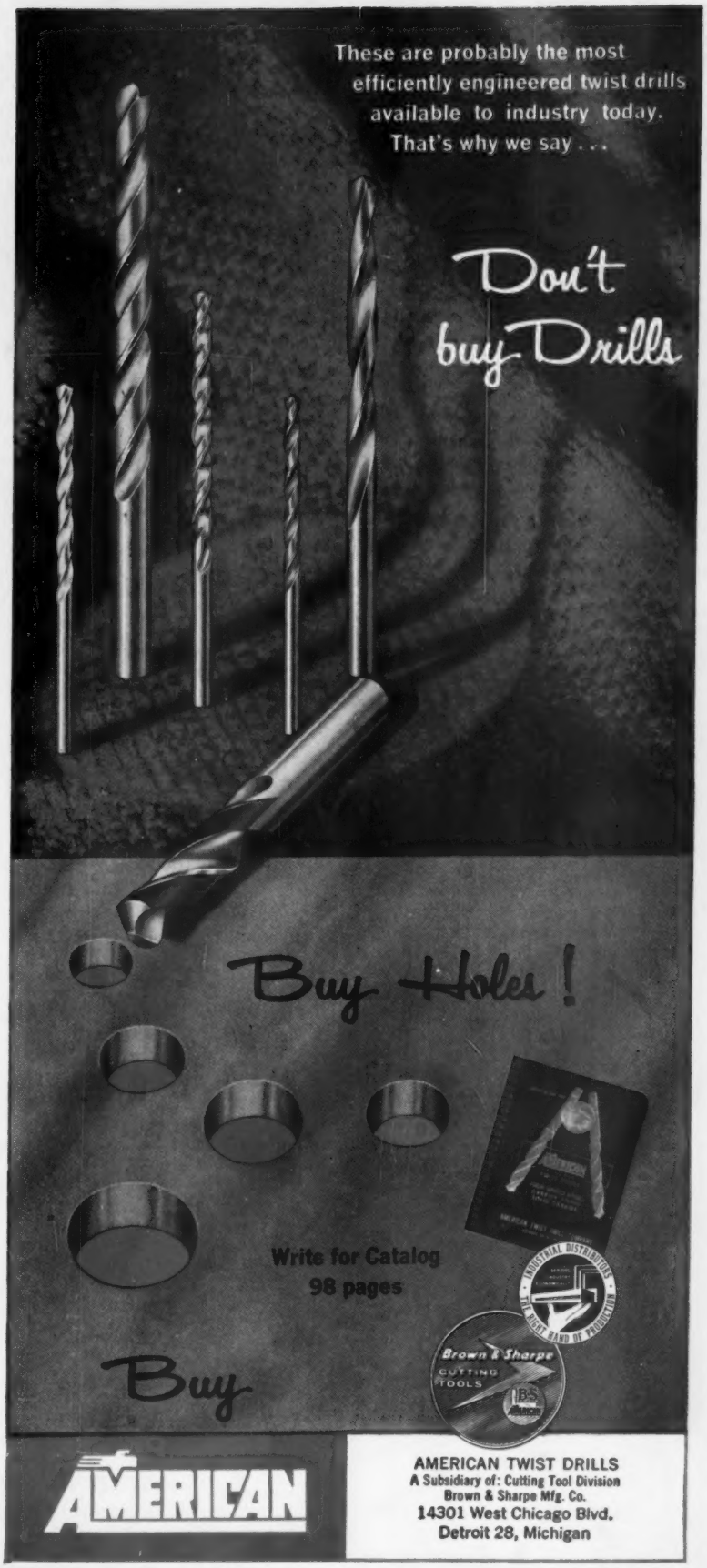
Speed of the headstock spindle is infinitely variable; axial stroke is also infinitely variable through a range of 0.086 and 0.236 in. Radial stroke is adjustable in four steps from 0.23 to 0.130 in.

For precision control of angles and surface smoothness, the headstock spindle movements can be made at slow feed rates and the infeed of the tool towards the grinding wheel can be adjusted in two planes with handwheels and feed screws, on which one dial graduation corresponds to 0.0008 in. stock removal.

Workpiece limits are: Max diameter 2 in., max length, 20 in. The machine comes equipped with a diamond dresser, and an 8⅝-dia 2-in. wide grinding wheel for $12,000 and up, depending on the attachments.

Dist by Eric R Bachmann Co, Inc, 27-11 41 Ave, LIC, NY

MORE DATA? Circle 113, inside back cover


These are probably the most efficiently engineered twist drills available to industry today. That's why we say . . .
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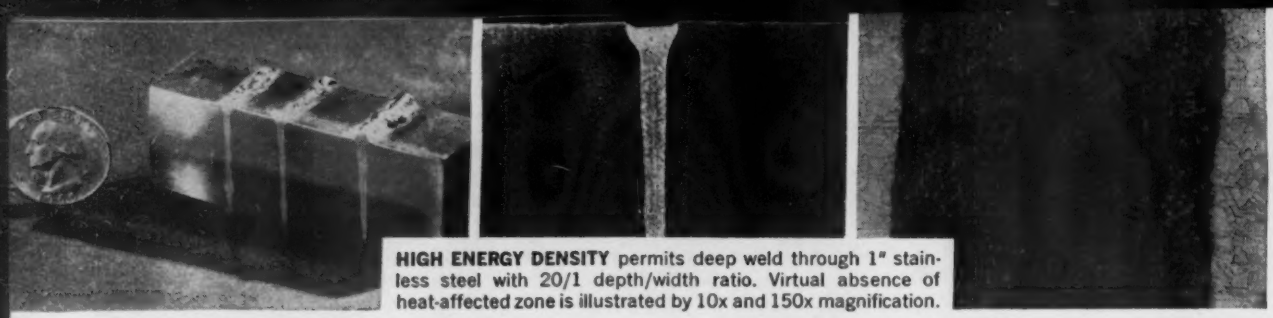
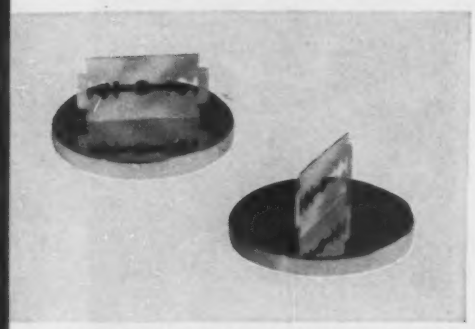


HIGH ENERGY DENSITY permits deep weld through 1" stainless steel with 20/1 depth/width ratio. Virtual absence of heat-affected zone is illustrated by 10x and 150x magnification.



PRECISION WELD of razor blade edge to stainless steel plate shows ability to weld very thin sections to thick sections.

CERAMIC WELD demonstrates ability of machine to effectively join materials which up to now were unweldable.

New Hamilton-Zeiss machine makes precise welds in today's most difficult materials and structures

A new and improved version of the famous Hamilton-Zeiss Electron Beam Welder has been designed, developed and is now being produced by Hamilton Standard.

The machine incorporates larger work chamber, more versatile work-handling equipment, higher power, simplified controls, and many other improvements. It makes deep or microminiature welds with hitherto unattainable precision. It can join dissimilar materials which have widely varying melting points, and weld virtually any refractory metal or exotic material. Hamilton-Zeiss machines are revolutionizing fabrication techniques and innovating new products throughout industry.

KEY ELEMENT OF THE MACHINE is an electron gun, which focuses up to 25 million watts per square inch on the workpiece. Pinpoint concentration means that areas only thousandths of an inch away remain cool and retain their physical properties without distortion. Minimized heat diffusion makes possible highly localized welds within any material or structure.

STRONGEST WELDS POSSIBLE are achieved because the high energy density beam operates in a vacuum; thus, oxidation and contamination problems inherent in other welding processes are eliminated. Moreover, the electron beam, by vaporizing impurities, actually produces welds as strong as the base materials.

WELD CERAMICS, TITANIUM, TANTALUM, MOLYBDENUM,

The new Hamilton-Zeiss electron beam welding machine will be demonstrated at the forthcoming 43rd National Metal Congress and Exposition, Cobo Hall, Detroit—October 23 through 27. Complete information on Hamilton-Zeiss machines for welding or for cutting is available from Hamilton Electrona, Inc., Time-Life Building, New York, New York.

UNITED AIRCRAFT CORPORATION

HAMILTON STANDARD DIVISION

ELECTRON BEAM MACHINES

CIRCLE 366 READER SERVICE CARD

Cross section of one of eight T welds on an 18-8 stainless steel thin-wall heat exchanger. (Unretouched photo.)

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The "Other Side" of CLOVER ABRASIVES

The most important side of coated abrasives is, naturally, *the cutting surface.*

But *the reverse side* can mean more to the user than the superficial appearance of the grit. It carries data on the bond, the weight of the cloth or paper, and the kind of grain. All of this has a great deal to do with the *performance* of the product.

Moreover, the manufacturer's name is a signature. If it says "Clover" on the back, you can be sure it is the best of its kind. Ask for a new Clover Catalog and get acquainted with our full line of abrasive products—*it is good business!*

Clover Manufacturing Company

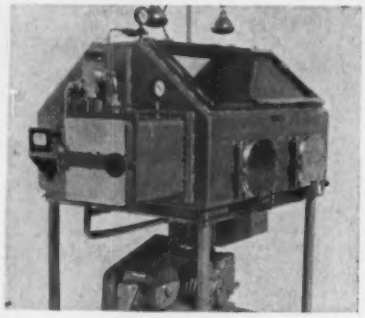
Norwalk, Connecticut

Victor 7-4515

Quality Abrasives Since 1903

Makers of the famous
CLOVER Grinding and Lapping COMPOUNDS

NEW SHOP EQUIPMENT



Inert Gas Welding Enclosure Has 40 by 40 in. Working Space

Designed for welding rare metals such as molybdenum, tantalum, columbium and zirconium that oxidize readily in air, the Eringard Mk II provides a 40- by 40-in. enclosure for inert atmospheres. Leak rate of the chamber is less than one micron per minute at a base pressure of one micron. Base pressure is produced with a 5 CFM pump. The vestibule is equipped with hermetically sealed pumpouts, vacuum gages and gas inlets so that material can be moved into and out of the box or main chamber without evacuating the latter.

Floodlights are mounted on the exterior for an unobstructed work area and a removable feed-through plate is provided at one end of the box for electrical, gas and water connections for use with heliarc torches.

Royal Research Corp, Hayward, Calif

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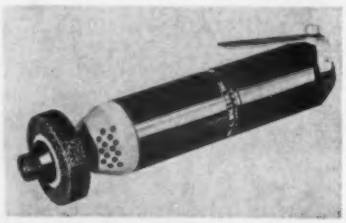


Small-Wheel Grinders Offered With Built-In Governors

Wilson has added to its line of Series 921 grinders spindle and collet chuck models with lever or pushbutton throttles and governed speeds of 12,000, 15,000, or 18,000 rpm. Both models are available with a wide variety of adapters to take small grinding wheels, rotary files, carbide burrs, sanding and cutting disks.

Thomas C Wilson Inc, 21-11 44th Ave, Long Island City 1, NY

MORE DATA? Circle 115, inside back cover

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 21

Subject: Resharpening Tap Chamfers:

As with all cutting tools, taps perform best when sharp. Dull taps cut rough and sometimes oversize threads; require more power and higher tapping torque which may effect tapping speeds. Teeth of dull taps chip, load and break, resulting in high tapping costs and excessive product spoilage.

Taps that have lost their keen cutting edge through constant use can generally be reconditioned by regrinding the chamfer provided the teeth are not badly chipped or are not heavily loaded with the material in which the taps were used.

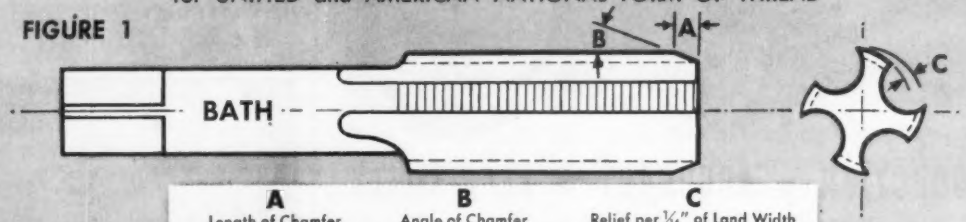
At best, resharpening tap chamfers properly by hand is a difficult if not impossible task and we do not recommend such a practice. (See Fig. 2). However, there are several machines and attachments on the market suited to this type of work and one of these should be used.

Care should be taken to grind the correct chamfer angle and chamfer relief when resharpening dull taps. This may be done by reproducing a new tap as closely as possible or by following the specifications in Fig. 1.

It is also important to retain the point diameter of the chamfer to approximately the same size as the root diameter of the tap (See Fig. 3). To accomplish this, it may be necessary to grind back the front end of the tap before regrinding the chamfer.

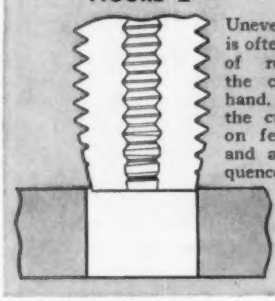
CHAMFER ANGLE AND CHAMFER RELIEF SPECIFICATIONS
for UNIFIED and AMERICAN NATIONAL FORM OF THREAD

FIGURE 1



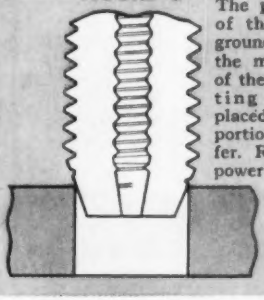
A Length of Chamfer	B Angle of Chamfer	C Relief per 1/16" of Land Width
Plug, 3 to 4 Threads	10° to 13°	.002" to .004"
2 to 2½ Threads	15° to 19°	.003" to .005"
1½ Threads	25°	.003" to .005"

FIGURE 2



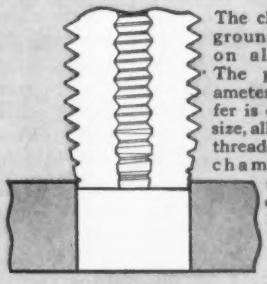
Uneven grinding is often the result of resharpening the chamfer by hand. This forces the cutting load on fewer lands and as a consequence, oversize holes and lower production per tap is the outcome.

FIGURE 3



The point diameter of the chamfer is ground too far below the minor diameter of the tap. The cutting burden is placed on a small portion of the chamfer. Result: greater power consumption and short tap life. End of tap should be ground back before resharpening.

FIGURE 4



The chamfer is ground evenly on all lands. The point diameter of chamfer is correct in size, allowing all threads of the chamfer to share the cutting burden.

When your taps are worn or chipped too badly for resharpening or if you are in need of new taps, call your Bath distributor or contact Worcester for carefully ground, high quality Bath taps, designed for precision tapping, long wear and low cost per threaded hole.

Send coupon for your 132 page Bath catalog describing Bath precision ground taps, gages, internal micrometers, tap and gage tables and technical data.

John Bath & Co., Inc. 22 Mann St., Worcester, Mass.

Please send 132 page catalog and technical data to:

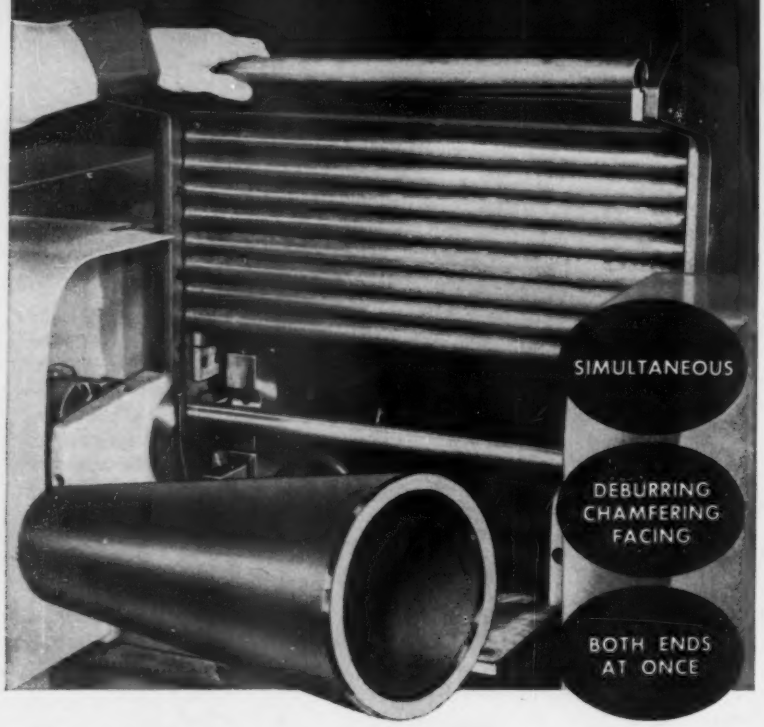
Name _____

Street _____

City _____ State _____

● Cylindrical and Thread Gages ● Ground Thread Taps ● Internal Micrometers John BATH & Co., Inc.
22 Mann Street, Worcester, Mass.

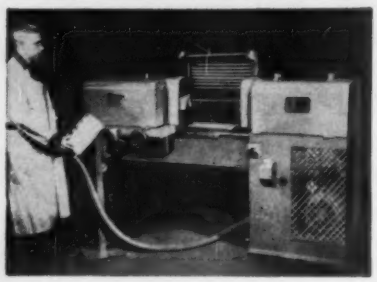
ANNOUNCING NEW PINES DOUBLE-END FINISHING MACHINE



HIGH PRODUCTION • ACCURACY • FLEXIBILITY

Filling the need for high production speeds and low unit costs, the new Model 666 Double-End Finishing Machine produces up to 1500 finished pieces an hour, holding length tolerances within .005". This new standard machine performs simultaneous inside-outside deburring, chamfering and facing, or light forming operations on both ends of tube, pipe, or rod. Workpieces are handled in diameters from ½" minimum to 3" maximum in lengths up to 60" on the standard bed machine, up to 120" on the extended bed machine. Operation is completely automatic with workpieces fed into machining position by the hydraulically operated Chute-Matic feed. Setup is fast with precision control of each machine function, easy adjustment to specific work length, and quick-change tool holders. Tooling is inexpensive with throw-away carbide bits. Special tooling arrangements are available to accommodate de-dimpling. Find out now how this machine can help you produce parts faster, and at less cost.

WRITE TODAY FOR COMPLETE INFORMATION.

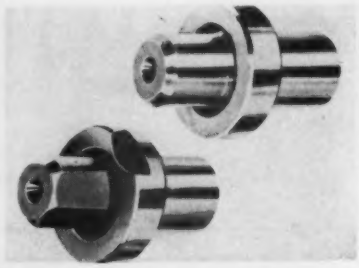


PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

c/o WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFER MACHINERY

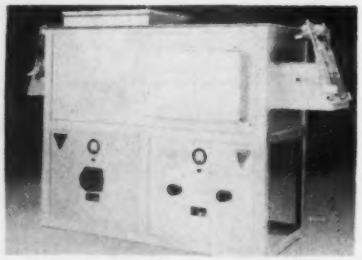


Two Styles of Locating Pins Offered in Wide Range of Sizes

Line of pins manufactured in both diamond and round styles is designed with a resting shoulder feature that permits them to serve as rest pads. They are available in 368 sizes ranging from ⅛ to 1½-in. head diameters. Both diamond and round shaped styles are carburized, hardened to RhC 60-62 for tough wearing surface with core left mild. The pins are used in bushing applications, also press fitted with lock screw holder.

Jergens Tool Specialty Co, 712 E 163rd St, Cleveland 10, Ohio

MORE DATA? Circle 116, inside back cover



High-Temp Electric Furnace Has Dual-Zone Operation

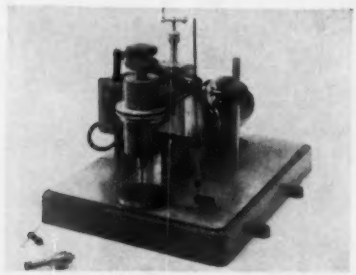
Model SNXKSG has two adjacent hot zones, one operating at 2900 F, the other operating simultaneously at 2300 F. The high-temperature zone is heated with molydiscilicide elements and the other with silicon carbide elements. Each chamber is controlled by its own individual tap-transformer and direct-reading input ammeter. In addition, each zone is equipped with its own temperature recorder, saturable core reactor, and magnetic amplifier.

Work is moved manually into the high temperature zone; after required processing it is then moved into the low (quenching) temperature zone after which it is removed from the furnace and put into suitable quench or bath. Though a furnace in this series is available in any multiple or combination of pre-heat, high temperature, and cooling zones,

approximate overall size of this unit is 43 in. wide x 105 in. long x 64 in. high. Each chamber has a work area of 6½ in. wide x 24 in. long x 2½ in. high.

Pereny Equipment Co, 893 Chambers Rd, Columbus 12, Ohio

MORE DATA? Circle 117, inside back cover

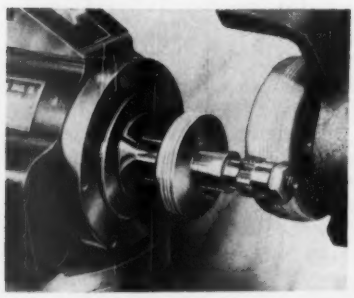


Small-Hole Drillpress Gives Column Adjustments to 0.001 in.

For precision drilling of small fine holes, the Micro drillpress has a micrometer screw on the column that can be adjusted over a range of two inches in thousandths. Powered by a 1/12-hp motor, the drillpress takes collets in sizes from 0.004 to 0.315 in. Throat depth is 4½ in. and spindle travel is 1¼ in. Special accuracy (0.0001 in.) collets can also be supplied.

F W Derbyshire, Inc, 265 Bear Hill Rd, Waltham 54, Mass

MORE DATA? Circle 118, inside back cover



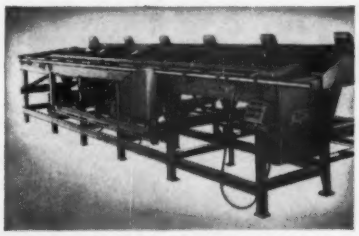
WHEEL CRUSHER for R-O universal form grinding equipment is available in two types: a collet-held crusher that requires removing work from the collet to redress the wheel but does not necessitate disturbing the fixture setup; second type is machined as a part of the workholding arbor. With this type redressing the wheel requires only sliding the table so that the crusher is brought opposite the wheel. Both types are designed and built to the customer's specifications by the manufacturer

—R-O Mfg Co; 31171 Stephenson Highway, Madison Heights, Mich

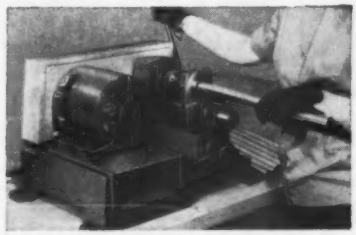
MORE DATA? Circle 119, inside back cover

4500 TO 6500 PIECES PER HOUR

Pines-Grieder Cut-Off Machines cut round tubing up to 4" diameter, with wall thickness up to .250", and will handle rectangular or other tube shapes. Any length is cleanly cut with extreme accuracy . . . dual shear cut eliminates tube-end distortion. Cuts steel, stainless, and non-ferrous metals in 1/3 second cycle time. With feed speeds to 600 ft. per minute, length of piece determines production rate. Tooling quickly and easily changed for various tube sizes. *REQUEST CATALOG 441*



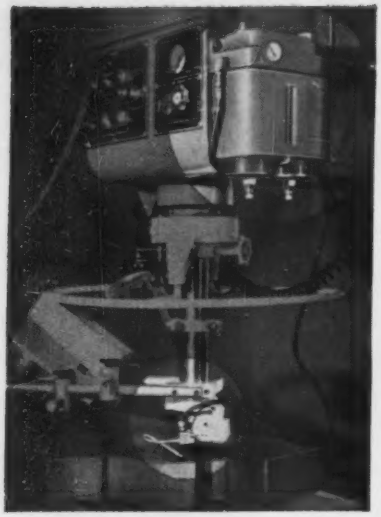
AUTOMATIC LOADER AND FEEDER for Pines-Grieder cut-off equipment. Frees operator by automatically feeding up to 15,000 lbs. of stock in lengths to 22′ through the machine. These units are also suitable for feeding other types of equipment. *REQUEST CATALOG 442*



PINES END FINISHING MACHINES simultaneously deburr, chamfer, face, tube, pipe or rod. Handle stock to 5" diameter with high production rates, long life accuracy. Quick, simple tooling and set up. Five models available, manual or automatic, to handle single or double end operations. *REQUEST CATALOG 401*

PINES ENGINEERING CO., INC.
670 WALNUT ST. • AURORA, ILLINOIS
Specialists in Tube Fabricating Machinery

★ NEWS NOTE: GRIEDER INDUSTRIES, INC. HAS BEEN MERGED INTO PINES, PIONEER BUILDERS OF QUALITY BENDING EQUIPMENT.



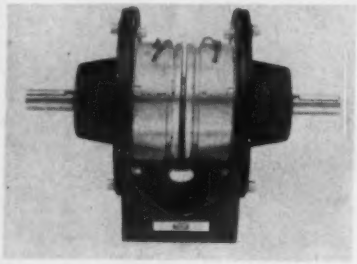
cool work instantly ...by evaporation

As you know, seeing what you're doing is half the battle, knowing what you're doing is the other half . . . and it will probably lead to Spraymist mist coolant systems by Bijur. With Spraymist on your machines an atomized coolant-air mixture instantly cools the work by evaporation . . . on contact. This keeps the work, the machine and the operator clean and dry—and insures complete, *full-time* visibility. The coolant starts from the pressurized reservoir and ends in a precisely regulated mist at the jet tip—not the tube—eliminating flooding, sputtering and condensate drip.

One economical Spraymist unit can supply 10 or more jets—each individually controlled by its own needle valve—insuring perfect cooling, at *all* operating speeds . . . on *any* machine. Why not yours? Write for details today and discover how inexpensive it is to add Spraymist to your production machines. 4141

BIJUR
LUBRICATING CORPORATION
153 West Passaic St. • Rochelle Park, N. J.
Pioneers in Automatic Lubrication

NEW SHOP EQUIPMENT



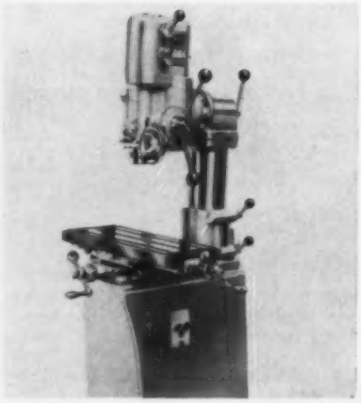
Electric Clutch-Brake Package Designed for fhp Applications

The Electro-Pack combines an electric clutch and an electric brake as a preassembled unit with input and output shaft extensions, ready to bolt in place and hook up the lead wires to the power source. It simplifies the design of new equipment and speeds conversion of existing machines to automatic duty-cycle operation. Up to several hundred machine cycles a minute can be accomplished by using the unit with a continuously running electric motor or other power input. The drive can be offset coupled through gears, belts, or chains, or in-line mounted between drive and driven shafts.

Electro-Packs are furnished in three sizes rated 10, 60, and 240-lb-in. static torque for maximum shaft speeds of 10,000, 7500, and 5000 rpm respectively at list prices of $132, $174, and $236 each.

Warner Electric Brake & Clutch Co, Beloit, Wis

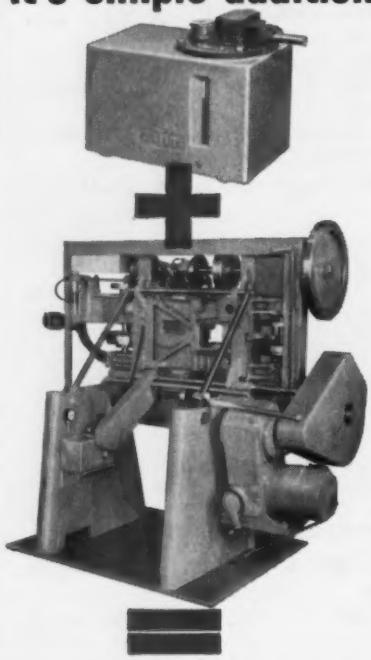
MORE DATA? Circle 120, inside back cover



VERTICAL MILLER type EM-825-A features a heavier column than the previous model and has relocated controls for greater convenience. Machine has a 9 by 22 in. table and 1 in. drilling capacity in steel. Price is $830—*Dist by Homestrand Machine Tool Corp, 392 W Putnam Ave, Greenwich, Conn*

MORE DATA? Circle 121, inside back cover

it's simple addition



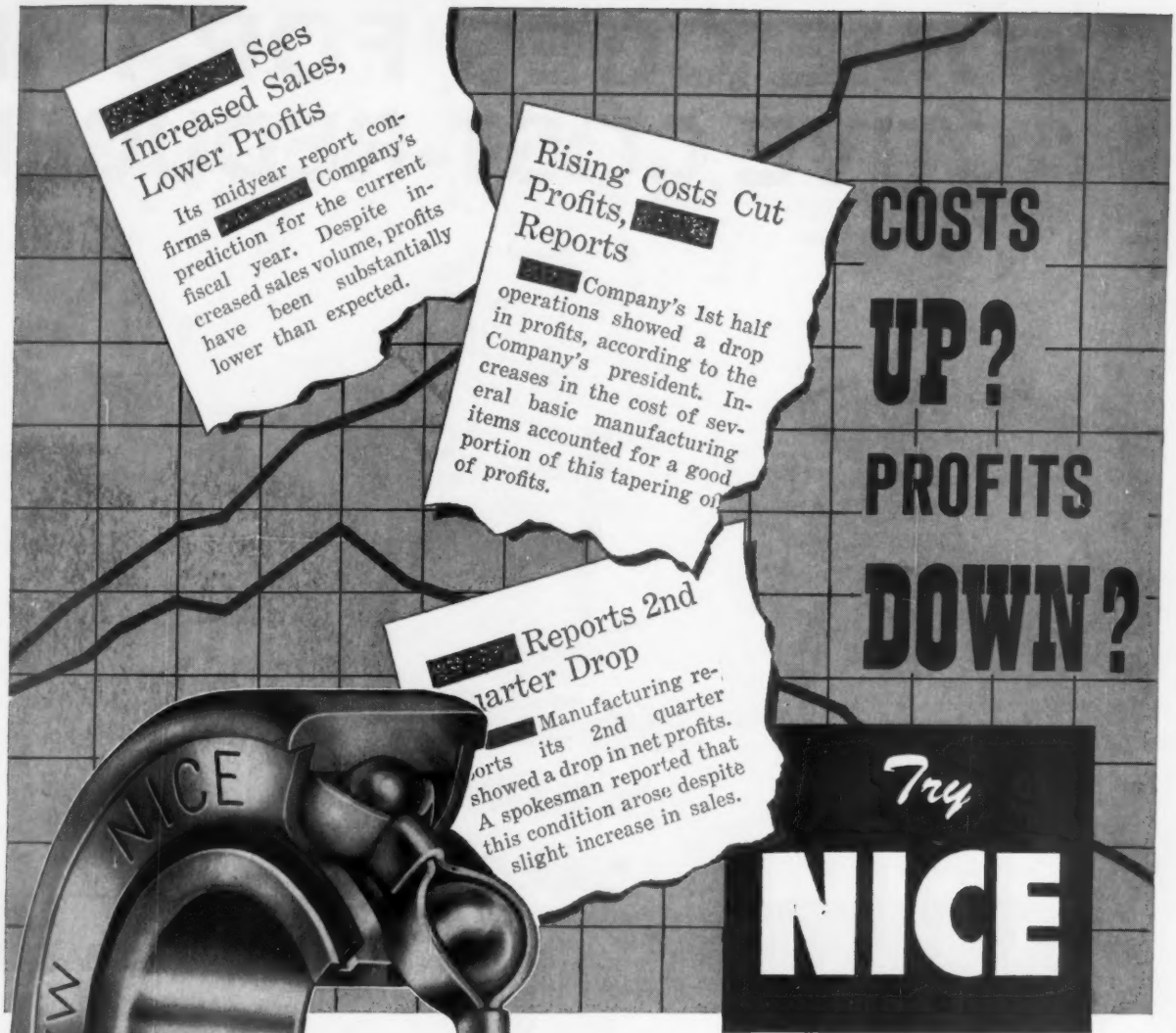
lower maintenance costs longer machine life and higher production

For years, machinery builders have been calling on Bijur to design the right automatic lubrication system for their machines. These manufacturers have learned that Bijur systems mean lower maintenance costs, longer machine life and higher production—advantages that add up to solid customer satisfaction.

No doubt *you* are now enjoying the advantages of Bijur systems on many of *your* machines. And, like most, you've probably noticed that these machines are outproducing others doing the same job. But did you know how simple and inexpensive it is—in both money and time—to convert these other machines to Bijur Automatic Lubrication? And the cost of Bijur systems is very quickly amortized. First-cost economy, higher production, plus *real* savings in maintenance costs and reduced downtime are the reasons for this rapid amortization.

When buying new machines, specify Bijur as original equipment. For now, write for complete details on the simple addition of Bijur Automatic Lubrication Systems. 4141

BIJUR
LUBRICATING CORPORATION
153 West Passaic St. • Rochelle Park, N. J.
Pioneers in Automatic Lubrication


[redacted] Sees Increased Sales, Lower Profits
Its midyear report confirms [redacted] Company's prediction for the current fiscal year. Despite increased sales volume, profits have been substantially lower than expected.
Rising Costs Cut Profits, [redacted] Reports
[redacted] Company's 1st half operations showed a drop in profits, according to the Company's president. Increases in the cost of several basic manufacturing items accounted for a good portion of this tapering of profits.
[redacted] Reports 2nd Quarter Drop
[redacted] Manufacturing reports its 2nd quarter showed a drop in net profits. A spokesman reported that this condition arose despite slight increase in sales.
COSTS UP? PROFITS DOWN?
Try NICE

for Performance and Price

Cost-conscious manufacturers will find many cost-saving advantages offered by NICE Ball Bearings. NICE can provide a complete range of standard or custom designed unground, semi-precision and precision bearings—and Product Designers can select bearings that insure a properly functioning product, yet one that is economically produced and competitively priced.

When cost is a problem... yet quality is a MUST... try NICE, for Performance and Price.

NICE®

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

SOME CUES FOR THE ACTIVE COST-REDUCER

This PLANNER is for the man who doesn't have time to waste determining whether a supplier can help him produce at less cost. If you're this type of active cost-reducer, we know we're welcome. It takes only five minutes to go through this PLANNER and not much longer to get us started on any project it may suggest. Like to have our man in your area call? Please contact Emhart Manufacturing Company, Hudson Division, Hudson, N. Y.

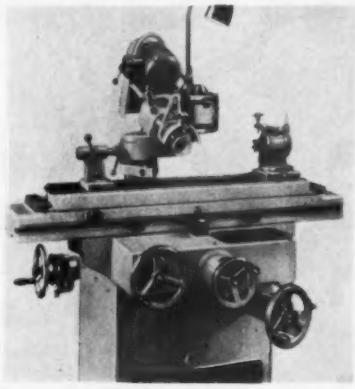
EMHART

COST REDUCTION IN SMALL PARTS PRODUCTION

This is our business — and to prove it, we'd like to go over at least sixteen areas in which we've had good, hard practical experience. Here they are:

1. PRODUCT DESIGN
2. MATERIAL AND PARTS FLOW
3. PACKAGING
4. FABRICATION
5. ASSEMBLY
6. DIRECT LABOR
7. INDIRECT LABOR
8. METHODS SIMPLIFICATION (People)
9. METHODS SIMPLIFICATION (Machines)
10. QUALITY CONTROL
11. IN-PROCESS INVENTORY
12. MAINTENANCE
13. FLOOR SPACE
14. SPARE PARTS INVENTORY (Customer)
15. SPARE PARTS INVENTORY (V & O Machines)
16. CRITICAL OPERATIONS

V & O
AUTOMATIC
PRESSES
AND FEEDS



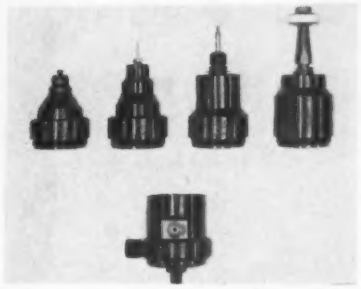
German Grinding Machine Is Multi-Purpose Unit

Blohm universal grinding machine and tool grinder can be particularly useful in smaller production shops. It is suitable for external and internal cylindrical grinding; surface grinding with horizontal spindle; surface grinding with vertical spindle, and for grinding all sorts of tools and milling cutters.

Table is provided with ball guide ways and moves so lightly that it can be easily operated by hand during tool grinding. It is operated by a handwheel between adjustable stops in surface grinding, and external and internal cylindrical grinding. The cross traverse mechanism which is used for external and internal work allows an infeed in increments of 50 millionths of an inch. Clamping area of the table for surface grinding is 8 x 16 and capacity for external grinding and tool grinding is 9/17-in. Swing over the table by 27 in. between centers.

Dist by Hermes Machine Tool Co, 48-15 Northern Blvd, Long Island City 1, NY

MORE DATA? Circle 122, inside back cover



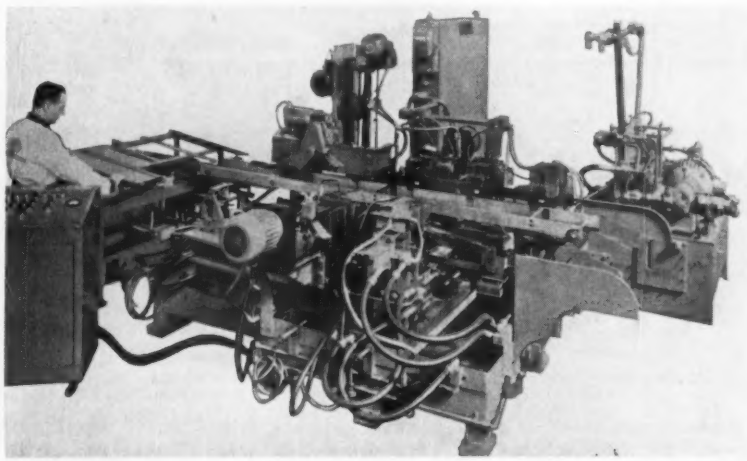
Vulcan Jig Grinding Attachments Give Up to 300,000-rpm speeds

Designed to provide the proper sfpm for small grinding wheels, the new 300 series vulcanaires have a speed range of 215,000 to 300,000 rpm, and the 5000 series, from 100,000 to 175,000 rpm.

This enables these jig grinding attachments to turn abrasive, carbide and diamond points at the proper speed for grinding holes from 0.020 to 0.090 in. (300 series) and from 0.090 to 0.250 in. (5000 series).

Vulcan Tool Co, 730 Lorain Ave, Dayton 10, Ohio

MORE DATA? Circle 123, inside back cover



COMPLETELY AUTOMATED LINE finishes ½-in. OD, high chrome-nickel, heat-resistant heating coils for electric ranges at 600 to 800 an hour. Machine, designed by The Vaill Engrg Co for an appliance manufacturer, scratch-brushes one end of tube, faces and chamfers both ends, sizes the ID, forms a simple head on both ends, flanges one end—*The Baird Machine Co, 1700 Stratford Ave, Stratford, Conn*

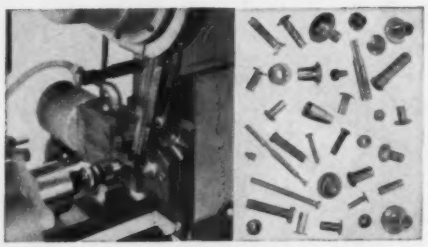
MORE DATA? Circle 124, inside back cover

NOW AVAILABLE...

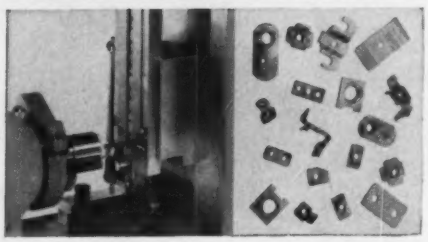
for automatic drilling, tapping or threading

Hand feed or hopper feed with or without air-operated clamp

NOW...drill rivets faster with minimum tooling costs



Drills 500-3600 per hour; hopper feed; air-operated clamping. Capacity #74 (.0225") to ⅛" in mild steel.

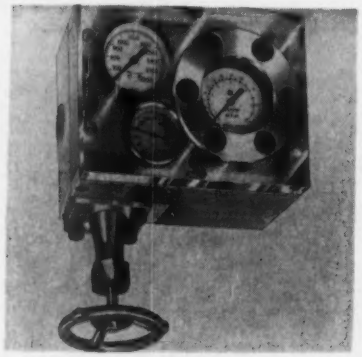


Taps 4000 per hour hand feed magazine. Capacity #0 to ⅜" fine pitch in mild steel.

A new horizontal version of the same operating principles long used in Snow vertical machines. Snow machines reduce changeover time, and cut tooling costs to a ridiculous minimum. On your next job, let us show you what the Snow method can do. Submit samples and prints.

Snow Manufacturing Company, Dept. A, 435 Eastern Avenue, Bellwood, Illinois (Suburb of Chicago)

SNOW *master fixtures save dollars and days in tooling costs*



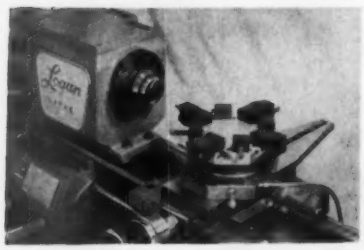
Instrument Pinpoints Problems In Hydraulic Systems

The 20-lb Hydra-Sleuth is designed for on-the-job use wherever hydraulics (up to 3000 psi) are employed. Unit incorporates flow, pressure, temperature gages, and a load valve for use in any position on hydraulic equipment.

Flow gage of the instrument reads directly in gallons per minute with two scale ranges, 0 to 10 gpm and 6 to 30 gpm with the scales calibrated for easy reading in both low and high gpm ranges. Pressure gage indicates loads up to 3000 psi and the temperature gage records from 20 to 240 F. When the instrument is installed on a piece of equipment, hydraulic troubles show up as a drop-off in gpm on the flow gage as working pressure is developed with the load valve. Trouble is then isolated to the pump valve or cylinder by taking flow, pressure, and temperature readings on various sections of the circuit.

Schroeder Brothers Corp, McKees Rocks, Pa

MORE DATA? Circle 125, inside back cover



MAG TURRET HEAD with eight station air-lock turret converts any make or size engine lathe into a chucking machine. The turret replaces an entire compound, eliminates tailstock and allows repeat indexing to 50 millionths of an inch, according to the manufacturer—*Logan Engineering, 4901 W Lawrence Ave, Chicago 30, Ill.*

MORE DATA? Circle 126, inside back cover

NOW...FROM WINSLOW

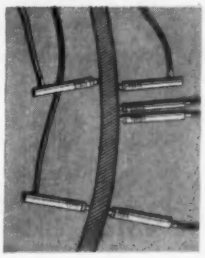
New electronic gaging systems

CUTS READING ERRORS

NO RECORDING ERRORS

NO VISIBILITY PROBLEMS

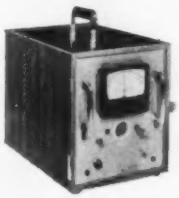
CUTS ACCESS PROBLEMS



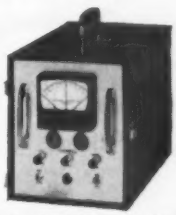
Uses Winslow Electronic Gaging Probes—sensitive transducers that substitute for standard dial indicators and most air probes in any mechanical "design" gage. Small size of the Probes (3/8" dia. x 2-13/32") allows locating check points where never possible before. Probes can be completely hidden. Console CS-24 (above) shows gage position and variation in lighted numerals 1" high, also prints this information on tape, card or sticker if desired. Push proper button to check any individual point, or machine automatically reads up to 24 gage positions and prints the results. Also reads "thickness" variation between any two opposed Probes. Accuracy possible to nearest .0001". Versatile—use with any number of "design" gages. Write for literature.

ALTERNATE READOUT DEVICES

Model IN-27 reads out a single Probe on meter scale. Can operate automatic sorting devices, etc. Can be ganged to read multiple points simultaneously.



Model LP-9 Electro-Chek* reads each of 9 Probes on the meter as you touch the button. Lighted digital lamp identifies gage position. Optional limit pointers.



Model LP-18 Electro-Chek* reads up to 18 contour points. Also reads "thickness" variation between any two opposed Probes. Compact. Versatile.

*T.M. Winslow Mfg. Co.

ACCURACY THROUGH ELECTRONICS

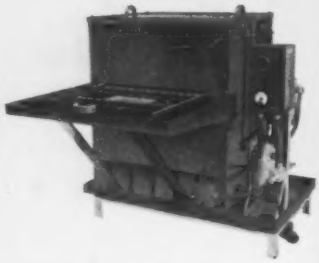
WINSLOW

MANUFACTURING CO.

1751 EAST 23 STREET • CLEVELAND 14, OHIO

Solve

Your etched product equipment requirements with



Model 700 Spray Etcher

For:

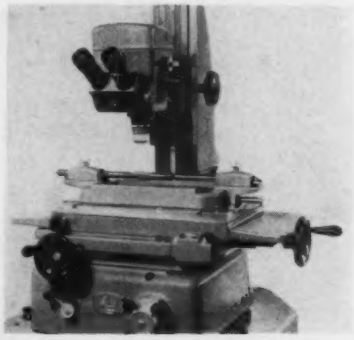
- Printed Circuit Etching
- Chemical Machining
- Nameplate Etching
- Decorative Etching
- Chemical Engraving

The CHEMCUT equipment line includes a model suitable for your lab or line production.

Want

to cut your operating costs and improve the quality of your product? Write now for data and name of distributor near you.

CHEMCUT
Div. of Centre Circuits, Inc.
P.O. Box 365, State College, Pennsylvania, U.S.A.



Leitz Toolmaker Microscope Introduced in New Model

New model combines an increased range of 3 x 8 in.; a purely optical measuring stage; and a binocular microscope tube.

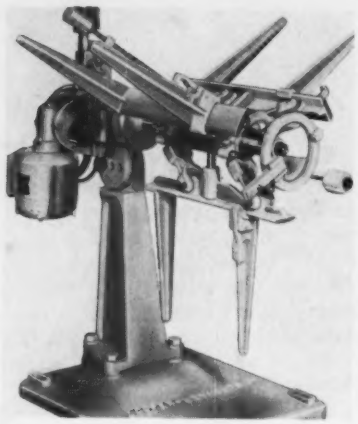
The 3 x 8-in. master scales are read directly in 0.0001 in. through a single projection window. These scales make the measuring operation in both directions fully continuous and very simple since no gage block dimensions have to be added to or subtracted from the master scale readings.

Binocular intermediate image tube retains the 1:1 relay system of the standard Leitz tube, plus a second relay ratio of 5:1.

With the same optics, two series of magnifications become available as 10, 20, and 30 X, as well as 50, 100, and 150 X. The new tube features 1:1 thread and radii charts, internal protractor reading in one minute, and a double-image adapter for checking center distances of holes.

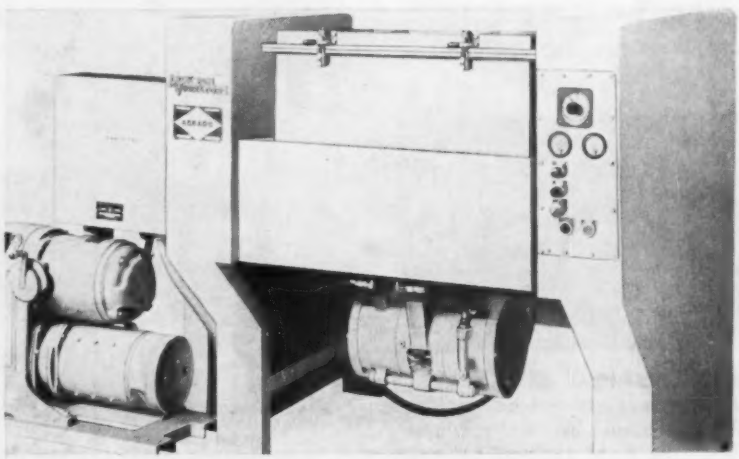
Opto-Metric Tools Inc, 139 Varick St, New York 13, NY

MORE DATA? Circle 127, inside back cover



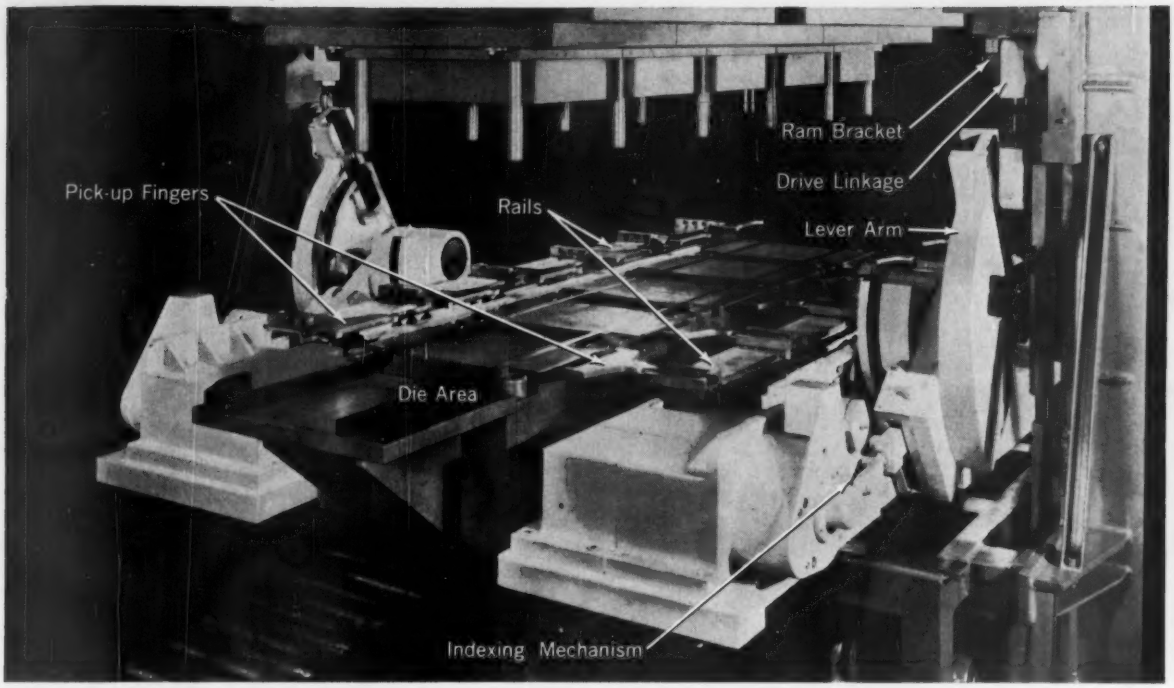
SERIES 1200 STOCK REELS are designed to handle coil stock in the intermediate weight range up to 1200 lb. Two models are available; plain and motorized, and both take stock widths to 18 in. with an OD coil of 48 in. Disc drag brakes are standard on all models and all rotating parts have ball bearings—*Cooper Weymouth, Inc, 600 Honeyspot Rd, Stratford, Conn*

MORE DATA? Circle 128, inside back cover



VIBRADO LINE OF VIBRATORY FINISHING MACHINES, which come in sizes from 1/10 to 20 cu ft capacity, are made by Jackson Vibrators, Inc, Ludington, Mich. The finishers feature full radius roll-over tub design, full 180° tilt for easy unloading, controlled orbital flow pattern with synchronous vibration—*Dist by Abrado Finish Corp, 1750 Elizabeth Ave, NW, Grand Rapids, Mich*

MORE DATA? Circle 129, inside back cover



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Sheffield provides complete single-source responsibility in PRESS-PACER production including (1) design and build tooling, (2) building of standard PRESS-PACER, (3) provision for minimum scrap and scrap removal, and (4) installation in your plant, warranted to perform to specifications and your satisfaction.

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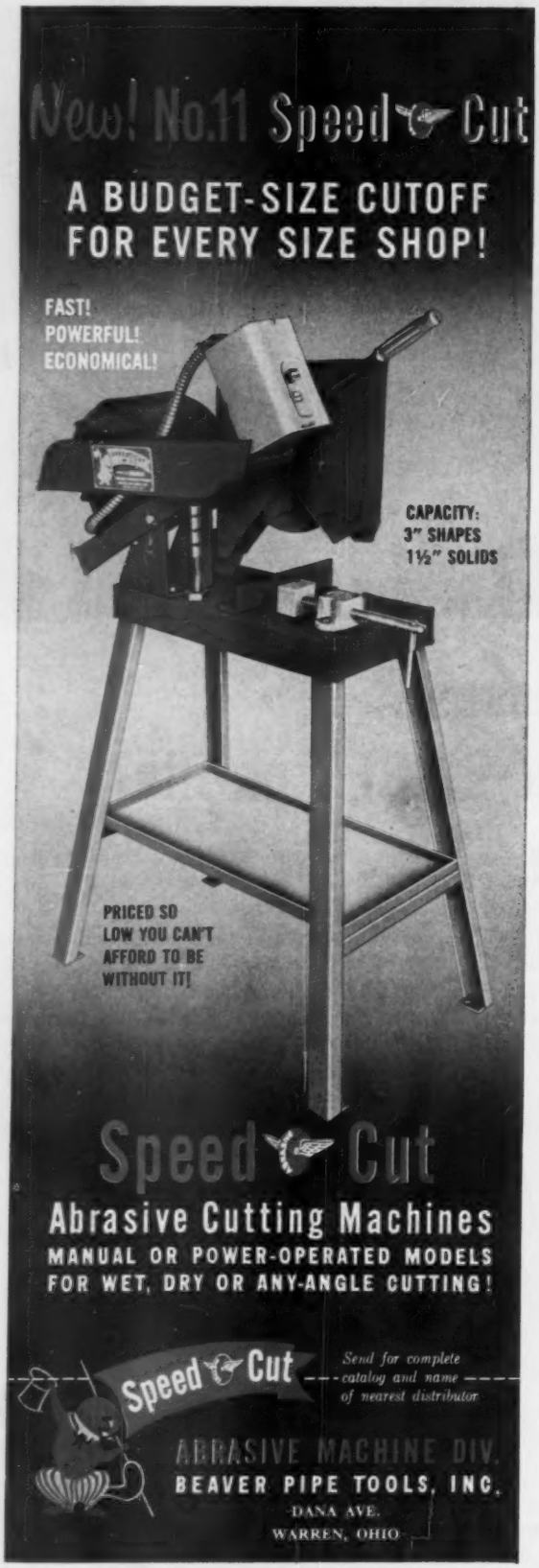

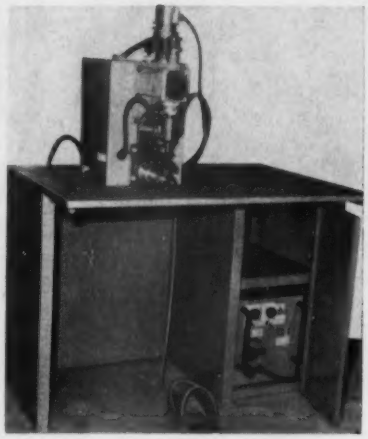

Aro Spot Welder Gives Fingertip Adjustment of Welding Pressure

Designated the ARO model M 33 V P, this spot welder will incorporate a variety of tip setups for handling a wide range of ferrous and nonferrous metals. Range of welding pressure from 0 to 330 lb is fingertip-adjustable and the welder can be air or foot operated without change-over. The completely water-cooled welder has 162 current settings from 900 to 16,000 amps on its vernier regulator.

Other features are a machined ram and guide sleeve, and a separate guide post for perfect alignment and minimum friction.

ARO Spot Welder Corp, 66-10 Woodside Ave, Woodside 77, NY

MORE DATA? Circle 130, inside back cover

8-in. DC Magnetic Brake Built to AISE-NEMA Standards

This shoe-type brake is built to standards for 600 series mill motors. Known as Clark Bulletin 106B, it employs the nut-cracker principle of operation. This design assures that equal pressure is applied against the wheel by both shoes which are self-aligning, symmetrical and duplicate —they fit either side, either end up. Magnet coil can be changed on the job without dismantling the brake.

Clark Controller Co, 1146 E 152nd St, Cleveland 10, Ohio

MORE DATA? Circle 131, inside back cover

with the Texaco "Cleartex Cure" you can

DECREASE REJECTS AS MUCH AS 22%

Diluted cutting oil in automatics can mean a high reject rate. Read why a "Cleartex Cure" ends this dilution problem forever... keeps tool sharp... assures dimensionally accurate work—and reduces rejects as much as 22%.

In spite of precautions, lube oil leaks into the cutting oil sumps of up to 70% of all automatics. Diluted cutting oil not only piles up rejects, but also means shortened tool life, more downtime and substantial discarded cutting oil losses.

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How to take a "Cleartex Cure." Getting the full benefits of a "Cleartex Cure" is easy. An experienced Texaco engineer will survey your automatic set-up. He'll tell you which machines will benefit from Cleartex. Our illustrated booklet, "Cleartex in Automatic Screw Machines," spells out the benefits of a "Cleartex Cure" in detail.

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Texaco Inc., 135 East 42nd Street, New York 17, N. Y. Dept. AM-121.

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- Their built-in quality lowers your manufacturing costs.
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THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

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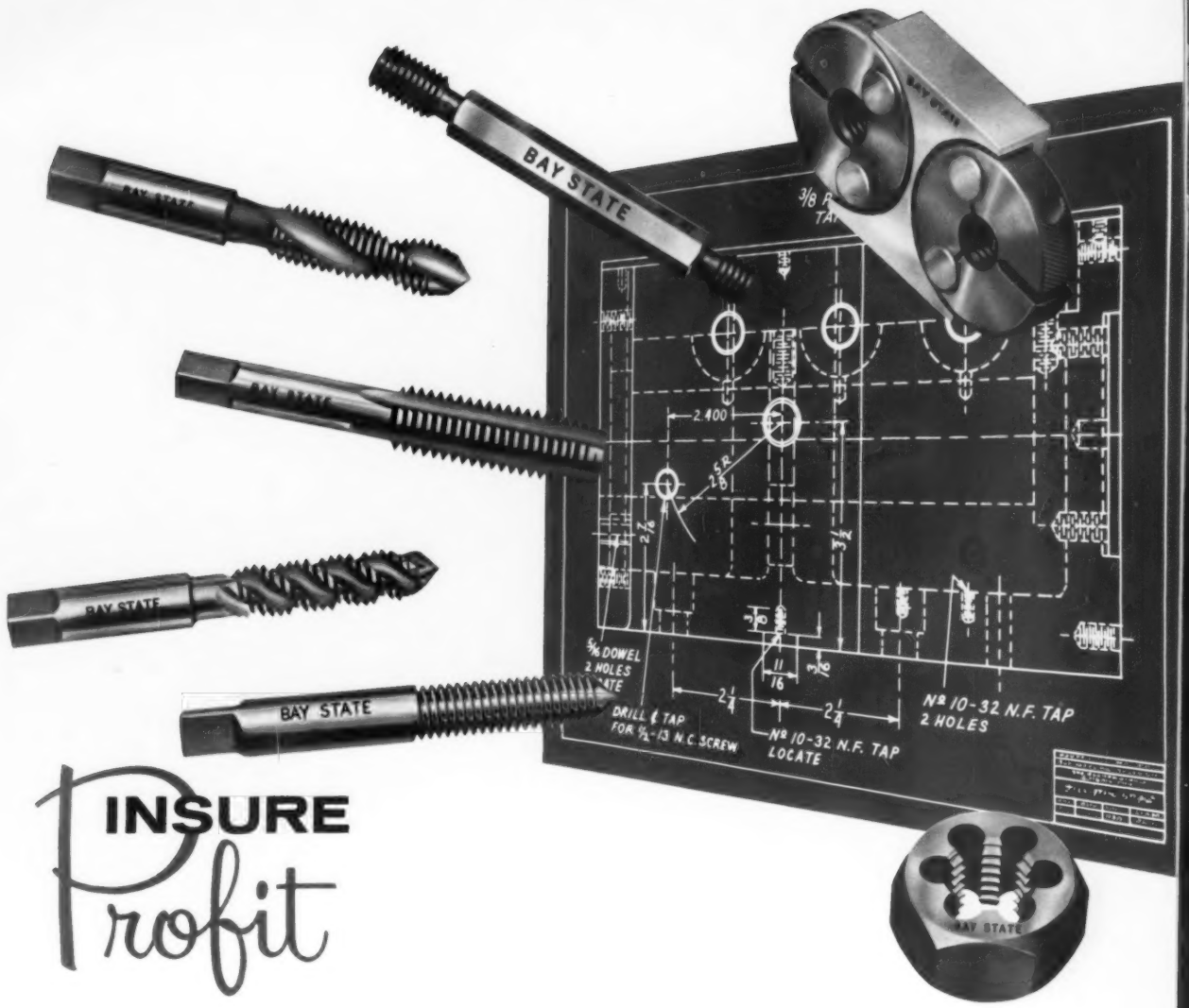

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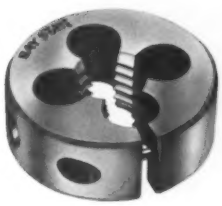

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- Skillfully engineered and manufactured to give you *more threaded parts per tool.*
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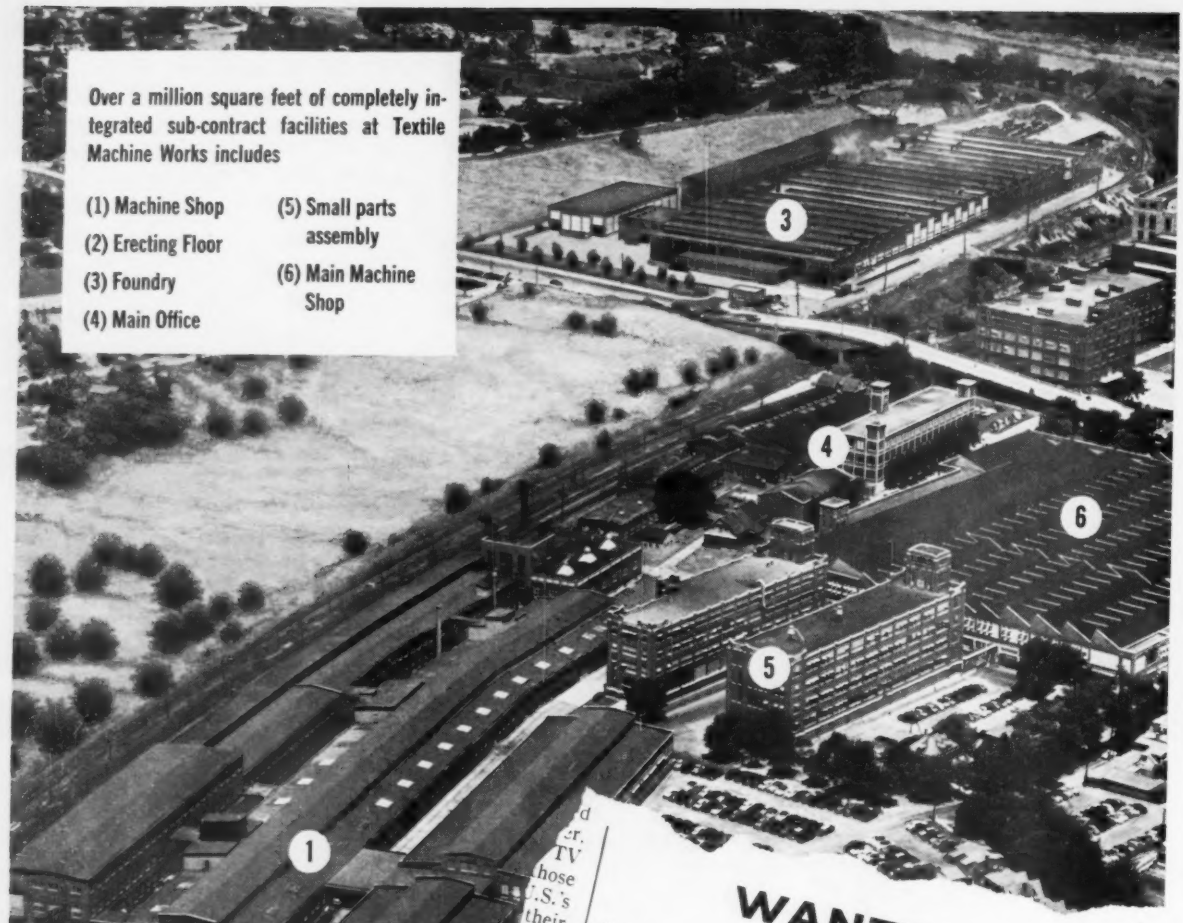

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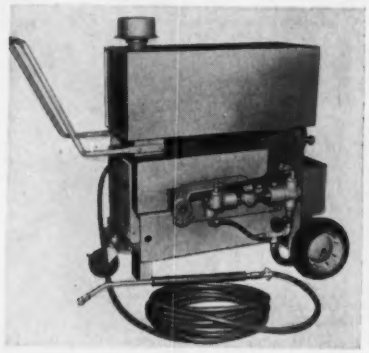


High-Pressure Cleaner Is Electrically Powered and Heated

The Jenny Multi-Job Washer for cleaning automobile bodies, engines, parts, machinery, equipment, trucks, and floors, is a self-contained unit that produces a degreasing or cleaning spray of 25 gph at 300 lb pressure and 100 degree rise in solution temperature, or a wash-rinse spray of 90 gph at 250 lb pressure and 25 degree rise in solution temperature. It has a float controlled water supply tank for continuous operation.

Model is offered in portable or stationary styles; operates on 230-v, 60-c, single-phase ac current. It is equipped with hose rack, 40 ft of solution hose, gun, and three nozzle tips; weighs approximately 155 lb.

Homestead Valve Mfg Co, Coraopolis, Pa

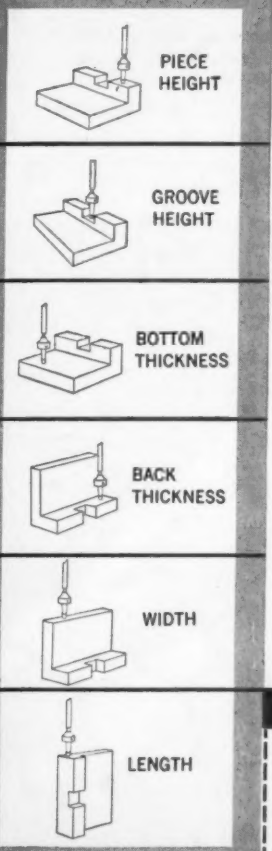
MORE DATA? Circle 132, inside back cover

BANDSAW CUTTING SHEAR cuts up to 2-in. widths without crimping or bending and is said to insure correct matching of blade in welding machines. In addition to cutting bandsaws, the shear can be used for general purpose cutting and as a throatless shear—*Stryco Mfg Co, San Francisco, Calif*

MORE DATA? Circle 133, inside back cover

6

DIFFERENT MEASUREMENTS ON THIS PART IN LESS THAN A MINUTE!



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(AS APPLIED TO MULTIPLE SPINDLE DRILLING)

Expertly Designed "HOLE HOG" Machine Tools for—

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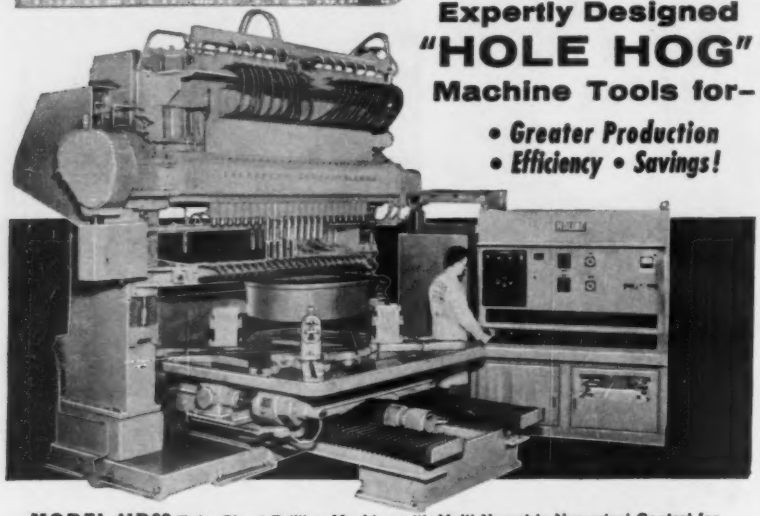

MODEL HD68 Tube Sheet Drilling Machine with Multi-Numetric Numerical Control for positioning of machine table in two directions and for selection of spindles. Information on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interruption.

60 years of Machine Tool Engineering Experience is at your service for—

115

• Multi-Spindle Boring • Single and Multi-Spindle Honing
• Straight Line Multi-Drilling • Adjustable Spindle Drilling
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automatic spray by DeVilbiss applies measured amounts of lubricants and coolants exactly where needed during metal-forming and machining operations with split-second timing. Fully adjustable for spraying duration, spray pattern size and shape. Get complete facts from: The DeVilbiss Company, Toledo 1, Ohio. Offices in principal cities.

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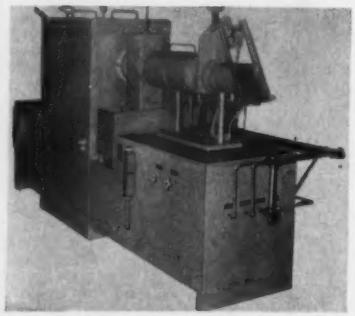
NEW SHOP EQUIPMENT



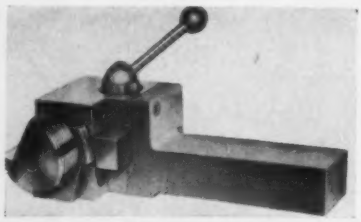
Manually Operated Tube Furnace Offers Choice of Quenches

Major feature of this heat treat furnace is a choice of quenches. Chute between the heat chamber and the cooling jacket permits either an oil quench or atmosphere cooling, dictated by requirements of the particular process. Automatic flame curtains at the entry or charging door, as well as at the discharge door, prevent infiltration of air into the muffle.

Known as Type RDT15-620AC20, the unit has a 6-in. ID Inconel muffle, a 20-in.-long heat chamber, a 20-in.-long water-jacketed cooling jacket, and obtains a maximum heating temperature of 2000 F. It is furnished complete with atmosphere flowmeter, piping, and valves.

Lindberg Engrg Co, 2450 W Hubbard St, Chicago 12, Ill

MORE DATA? Circle 134, inside back cover



Single Chaser Vers-O-Tool Trips Automatically

Namco's single chaser Vers-O-Tool backs off automatically at the end of the cutting stroke, boosting short run threading efficiency. Designed to prohibit any return stroke while at cutting depth, it eliminates scrappage from damaged threads.

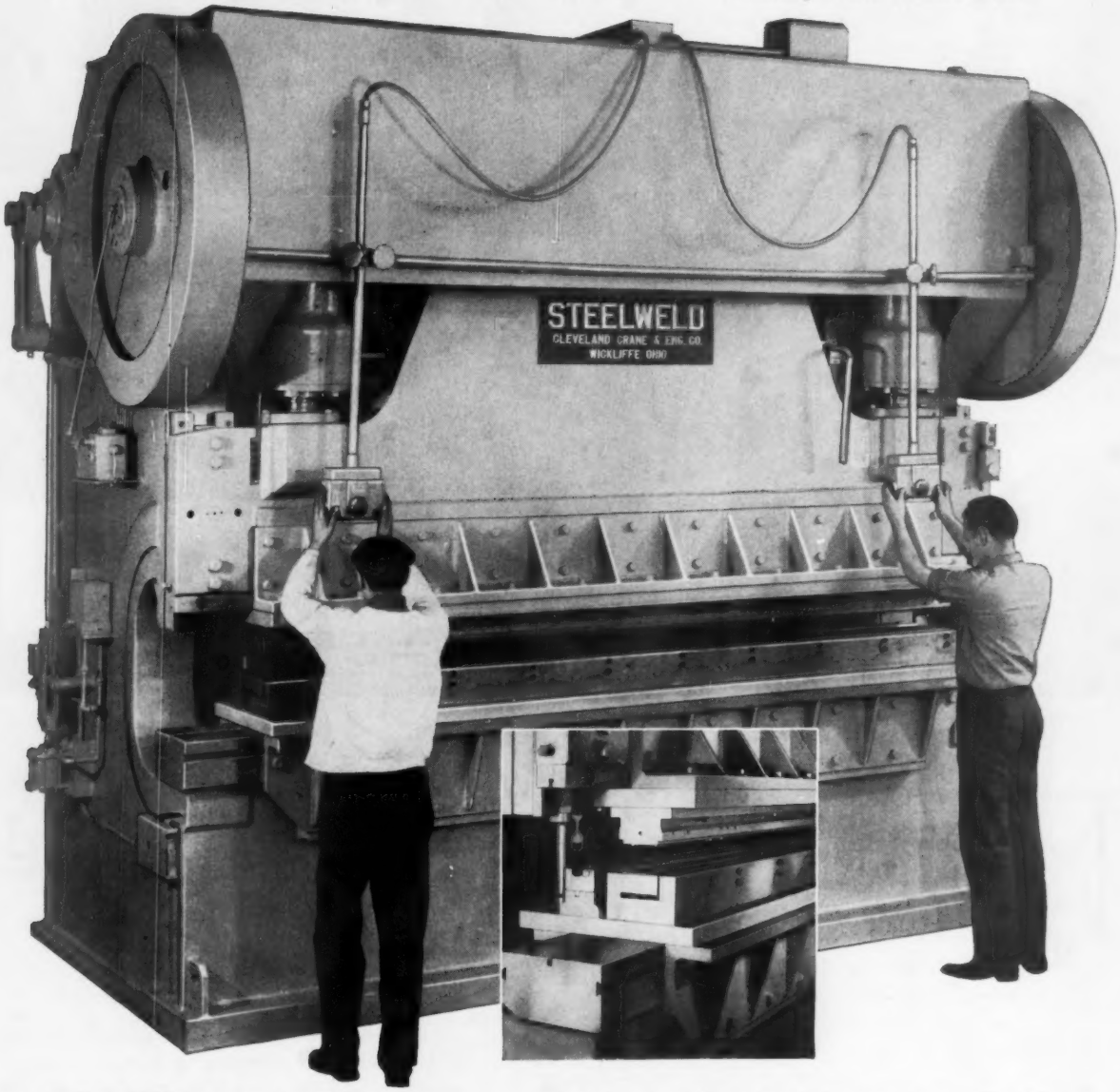
Available in two sizes, for fine or coarse threads, the unit can be used on any lathe equipped with a leadscrew and will cut taper threads with any standard taper attachment.

National Acme Co, Threading Tools Div, 170 E 131st St, Cleveland 8, Ohio

MORE DATA? Circle 135, inside back cover

STEELWELD PRESS BRAKE CUTS FORMING COSTS

Fast Two-Step Operation Speeds Trolley Duct Production



ELECTRIC trolley duct is turned out at a high rate on a Model K5-10 Steelweld Brake. The machine is fitted with removable bed and ram brackets to provide the width necessary to support two sets of dies. The front dies flange both sides of steel strips. The rear dies form the flanged strips into ducts. Thus, with each stroke of the ram, two operations are performed and a trolley duct completed. As many as 20 ducts can be produced per minute, which is the speed of the machine.

Two men normally work at the press, and each is provided with a set of control buttons. As a safety measure, two "run" buttons, requiring both hands of the two men, must be depressed to operate the machine.

This machine has air-electric control which eliminates the need of any cross shafting at front for mechanical foot treadles. Air-electric control makes push-button operation possible and provides fast, positive clutch and brake action.

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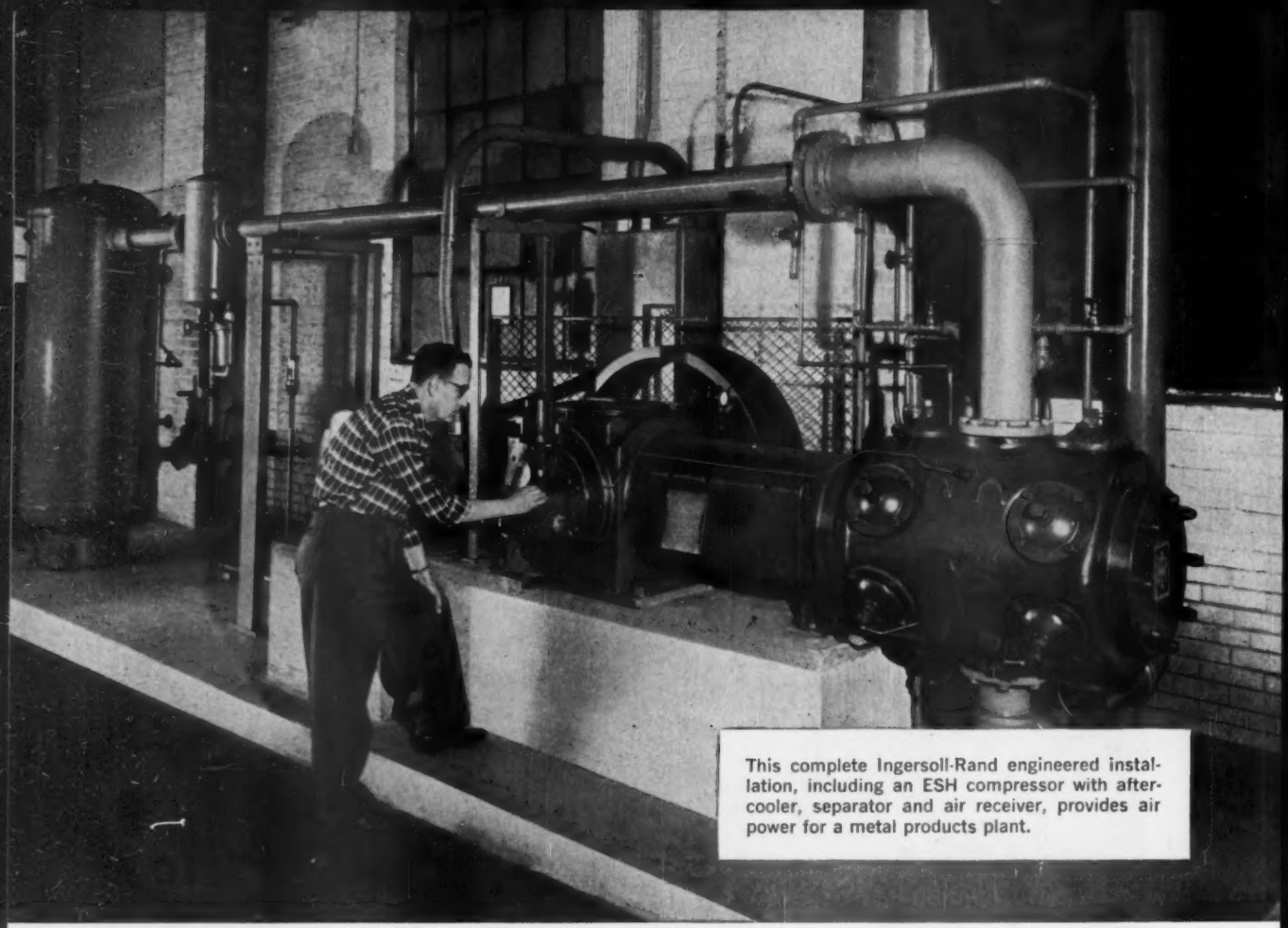
Mechanical and Hydraulic

PRESS BRAKES

Steelweld Machinery Includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING COMPANY · 1472 EAST 281st STREET · WICKLIFFE, OHIO



This complete Ingersoll-Rand engineered installation, including an ESH compressor with aftercooler, separator and air receiver, provides air power for a metal products plant.

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TIME TELLS THE DIFFERENCE

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"No bearing wear in 60,000 hours"..."43,680 hours with no valve maintenance required"..."63,648 hours with no forced maintenance"..."13 years without even *cleaning* the valves". That's what our customers have been telling us, and there are many more true case histories like them which prove the *long-range economy* of Ingersoll-Rand compressors.

The *extra value* that's built into every type of Ingersoll-Rand compressor pays off with reduced maintenance and attention over many years of operation, and the result is big savings in the cost of your air power. Ingersoll-Rand offers also the *most complete* line of compressors, in reciprocating, centrifugal, axial-flow, rotary and thermal types. There are units from ½ to 25,000 hp, for pressures from one micron to 125,000 psi. Call your I-R man today for help on your job.

ESH	PHE	XLE	PRE	HHE	XPV
20 to 150 hp	75 and 100 hp	125 to 350 hp	400 to 2000 hp	200 to 4000 hp	(steam-driven) 200 to 1500 hp

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AIR-CUSHIONED CHANNEL VALVES
Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action, prevent impact. Separate stainless-steel seat plate may be turned over or replaced for new life.

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Never need fitting or adjustment. They "roll with the punch" of each stroke, to distribute the load evenly over inside and outside surfaces.

FULL FILTERED PRESSURE LUBRICATION
Filtered oil under pressure to all bearing surfaces cuts wear to minimum.

SEALED FRAME
Keeps out dust and dirt, the major cause of wear. Keeps oil in.

and the World's
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Universal H Angle Plate Introduced by Rahn

Diabase angle plate, made in the form of an H, is currently available in two sizes, 6x6x6 in. and 6x9x6 in. Each is made in two grades; in the laboratory grade each of the twelve 90° angles is made to a tolerance of 25 millionths TIR over the entire faces; in inspection grade, these tolerances are 50 millionths TIR.

Advantages claimed are: face of the H-section provides more space for clamping and clamps may be placed down to the bottom; angle plate need not be clamped to a surface plate in most cases because the weight opposite the face to which the work is clamped compensates for the weight of the work; placed on its side, the angle plate can be used as a pair of precision parallels; bases are large enough so that it can be used as a riser.

Rahn Granite Surface Plate Co, 644 N Western Ave, Dayton 7, Ohio

MORE DATA? Circle 136, inside back cover

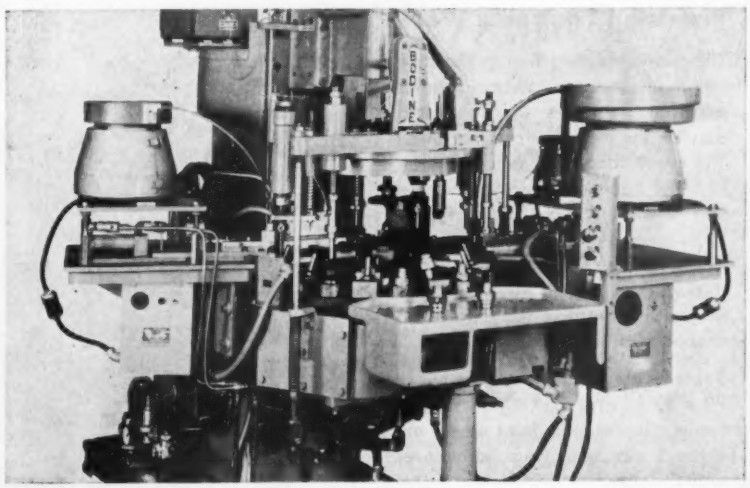
Dovetail Form Toolholder Designed for Automatics

Grip-Lock DFT is a ⅝-in. model with a 10° front rake (fits front and rear slide) for single-spindle automatic screw machines. Claimed to effect savings of 40% over the cost of conventional circular form tools, it is said to make possible greatly improved finishes on production parts, and is quicker to set up. When returning after sharpening, a scale may be used to align the cutting edge with the centerline of the production part. Little or no adjustment is normally required. Often, the removal of only 0.010 in. is adequate for sharpening.

Company also provides the option of dovetail form tool blanks which can be ground to specific forms by the user, or hardened or soft ground cutters in sizes ¾ x ¾; ¾ x 1; and ⅞ x ⅞ in. The blanks and finished cutters are available in Dynavan, Vasco-Supremen, CT-15, Circle-C, and other materials as required.

Royal Machine & Tool Corp, 31 Deming Rd, Berlin, Conn

MORE DATA? Circle 137, inside back cover



TYPE 42-30 ASSEMBLY CHASSIS is tooled for two-pass operations on automotive valve. On first pass, bronze bushing is hopper fed into valve and inserted by machine slide; a sizing ball is pushed through bushing, and bushing ID is checked with air gage. On second pass, part is removed from nest fixture and placed over mandrel fixture while a check valve is assembled. Thus one part is completed at each stroke—*Bodine Corp, 317 Mt Grove St, Bridgeport, Conn*

MORE DATA? Circle 138, inside back cover

New . . . Model 1A

LINLEY

JIG BORING MACHINE

Improved Accuracy For Precision Toolroom Work

The new Linley Jig Boring Machine has many features insuring greater accuracy that are usually found only on the higher priced machines. The entire table and saddle assembly has been greatly increased in size and weight for more rigidity and improved balance characteristics. Precise operation is assured through the use of square edged ways with positive no-shift table and saddle locks.

Table size and movement are 7" x 17½" and 6½" x 10" respectively. Guaranteed lead screw accuracy, one ten thousandths over entire range.

Send for full details, price.

LINLEY BROTHERS CO.

664 State Street Ext.

Bridgeport 1, Conn.

Wash Tank Stand Also Serves As Tool Storage-Rack

Unit designed for use with honing machines provides quick washing of workpieces and safe storage for arbors and mandrels. Equipped with a 12x28x12-in. wash tank, the stand occupies floor space 28 in. wide x 32 in. deep.

The ground-surface worktable is 34 in. high and includes parallels as tool and workpiece rests. An inclined rack holds arbors and mandrels, separated to prevent damage and to drain oil. Side rack holds drive-pin punches and hammer. Above the drain-mesh false bottom of the tank, a valve-equipped hose enables an operator to control washing of workpieces.

J C Thompson Tool & Die Co, 3000 Engle Rd, Fort Wayne, Ind

MORE DATA? Circle 139, inside back cover

Small-Wire Welder Works In All Positions, Uses CO_2, Inert Gas

The semi-automatic Miniarc welder welds light-gage metals in any position with small-diameter wire electrodes and inexpensive CO_2 or gas mixtures.

Equipment consists of an AM-8 torch, WC-5 control with wire drive, interconnecting gas and flexible conduit assemblies. Wire feed rate is from 55 to 500 ipm using wires of 0.25, 0.30, and 0.35 in. In addition to using CO_2 and argon-CO_2 mixtures the welder will work with argon and helium for welding alloys.

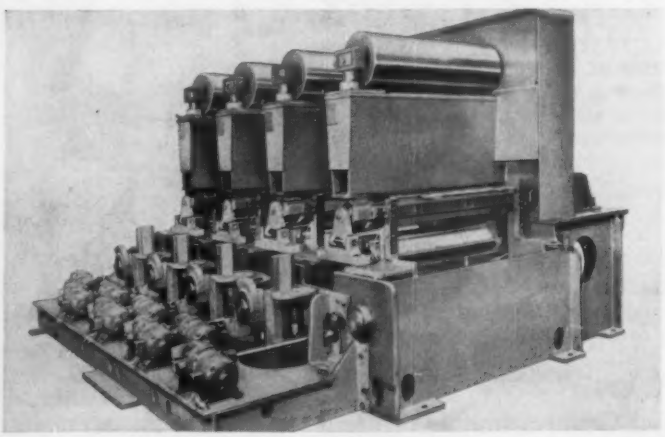
Price of the gun is $175 and the control, $600. Welder with single phase pre-set slope control costs $495, and one with 3-phase adjustable control, $850.

National Cylinder Gas Div, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill

MORE DATA? Circle 140, inside back cover

AUTOMATIC DECOILING and cut-to-length line consists of a coil reel; straightener or leveler/measuring unit; hump table; shear; and conveyor unit. Various capacity lines are available with a maximum sheet thickness of 3/16 in. and 72-in. width. Cut length accuracy of ±0.008 in. can be provided—*Lenox Tool & Machine Builders, Dept 344, Lima, Ohio*

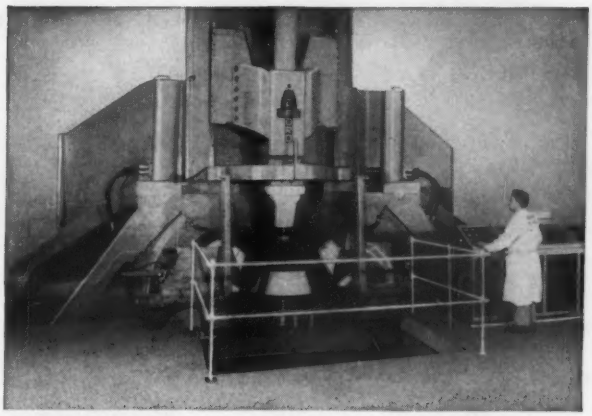
MORE DATA? Circle 141, inside back cover



FOUR HEAD GRINDING AND POLISHING MACHINE will process stainless coiled strip 0.010 in. to 0.250 in. thick and 50 in. wide. Said to be the world's largest, the grinder polisher has four endless abrasive belts running over two-roll heads with motorized adjustable steel billy rolls for increasing the belt pressure against the steel strip—*Hill Acme Co, 1205 W 65 St, Cleveland 2, Ohio*

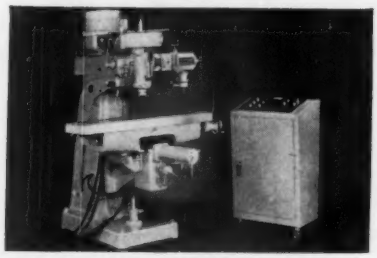
MORE DATA? Circle 142, inside back cover

ACCEPTED ACCURATE AUTOMATIC



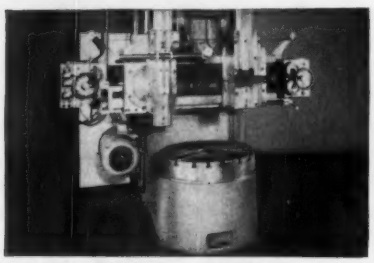
Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.



Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

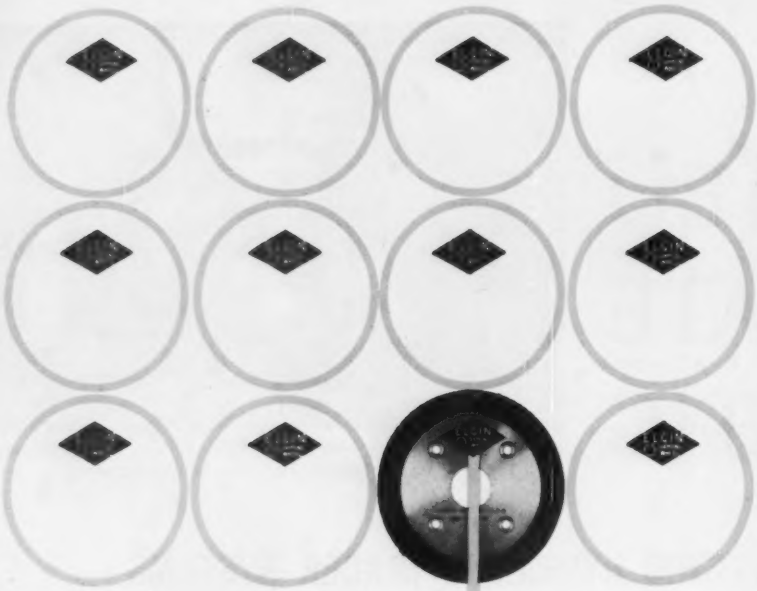
ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM 10-61 Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

Honeywell

First in Control



the only diamond that outdoes the wheel

That's no reflection on the diamond in this Elgin wheel. It's just that the diamond we're pointing to above—the Elgin symbol—stands for *all* the fine qualities in Elgin Diamond wheels.

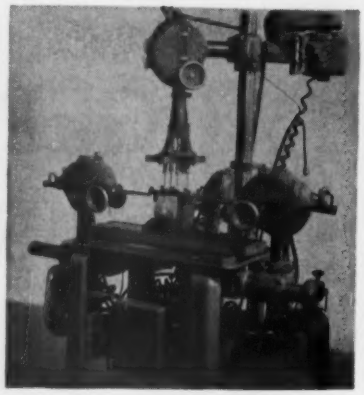
The Elgin Diamond symbol represents our uncompromising production standards. It stands for the top quality performance we demand from every Elgin wheel. It is your assurance that the wheel recommended by your Elgin engineer will do the job you need done and do it best.

Contact Elgin whenever tolerances and surface finishes are critical. Specify Elgin wheels.

Call your local Elgin Abrasives distributor or write for catalog.

ELGIN

ABRASIVES DIVISION
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS



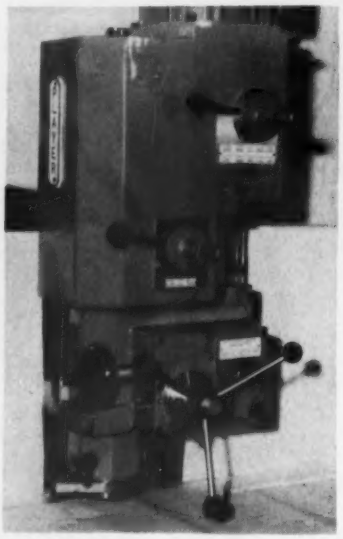
Multi-Headed Drill Machines Workpiece From All Angles

Multi spindle machine can simultaneously drill, counterbore, tap and ream a workpiece from almost any angle. The Versa-Matic drill has heads that revolve 360° both horizontally and vertically either over or under the worktable.

Equivalent in size and power to a 17 to 20-in. drillpress it performs as a special machine for continuous runs, yet will accept all standard drill attachments.

Van Norman Machine Co, Springfield, Mass

MORE DATA? Circle 143, inside back cover



SELF CONTAINED MILLING HEAD that fits standard machines has manual controls that allow the operator to feed the spindle through rack or worm feed. Offered in several horsepower ranges, all the heads have 8 or 16 speeds, 3 quill feeds, pressure lubrication, automatic kick-out for power feeds—*Joseph Player, 37450 Wick Rd, Romulus, Mich*

MORE DATA? Circle 144, inside back cover

Deburring time reduced one-half at AiResearch

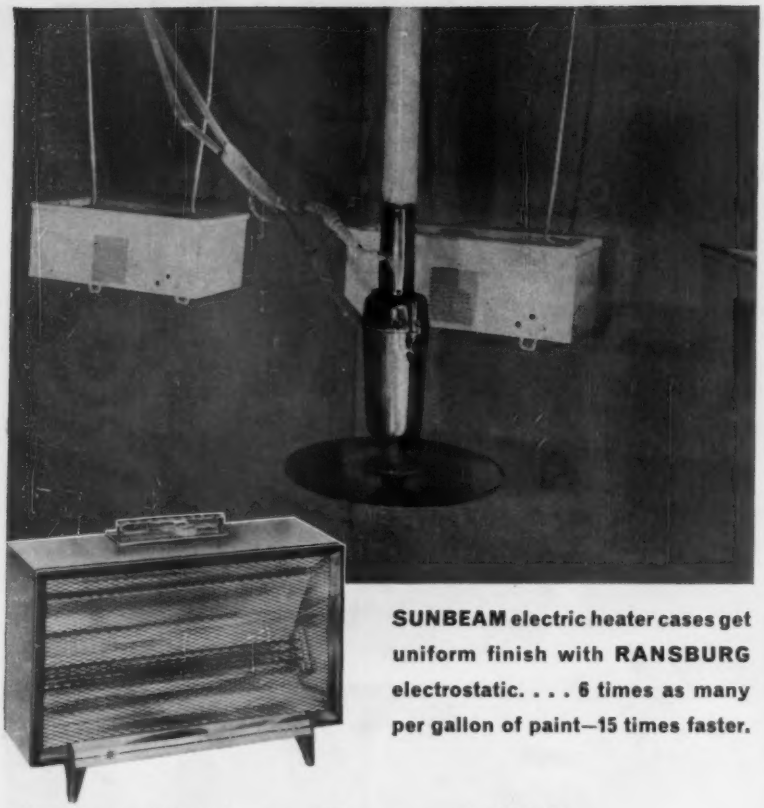
The SWECO *Vibro-Energy Finishing Mill* has reduced deburring time 50% at the Garrett Corporation's AiResearch Mfg. Div., Los Angeles. Before installing the SWECO Finishing Mill it took 10 minutes to deburr one part. Now the SWECO Mill does many parts at once. ⌘ Originally AiResearch ordered two SWECO Finishing Mills. After checking results, four more were ordered. ⌘ AiResearch manufactures precision aircraft, missile and other military equipment where finishing is highly important. SWECO'S Vibro-Energy principle produces a controlled, consistent product, with all surfaces, even edges and recesses, uniformly finished. The open-top design makes it easier to inspect parts without stopping the unit. Cleaning and changing of media have been simplified because unlike other mills which have to be tilted for unloading, the SWECO Finishing Mill practically unloads itself when the plug is pulled. ⌘ For full details, application data, and a laboratory test using *your* materials, write SOUTHWESTERN ENGINEERING CO., 4800 Santa Fe Ave., Los Angeles 58, Calif., Dept. 77381.

SWECO

*Vibro-Energy*finishing mills, separators, grinding mills*

*TM SEC

See our exhibit at the Detroit Metal Show, Oct. 23-27



SUNBEAM electric heater cases get uniform finish with **RANSBURG** electrostatic. . . . 6 times as many per gallon of paint—15 times faster.

"Paint Mileage Leaps 500%.... Production Upped 15 Times" Reports ENAMELED STEEL & SIGN CO.

Curt Simmons, President, ENAMELED STEEL & SIGN COMPANY of Chicago, describes results with RANSBURG Automatic No. 2 Process Electro-Spray: "We first painted cases for the new SUNBEAM portable electric heaters with air hand spray at the rate of 200 pieces per day using 6 gallons of paint. Now, with RANSBURG electrostatic we've increased production 1400% to 3000 pieces daily with only 15 gallons of paint." An increase of 500% in paint mileage! *What would savings like this mean in your finishing department?*

QUALITY IMPROVED WITH RANSBURG ELECTRO-SPRAY

Sags and runs, a problem with the air hand spray, have been eliminated with the automatic electrostatic equipment. Mr. Simmons adds: "Now we achieve a uniformity over the configurated area which wasn't always possible before. We know the 50,000th piece will turn out the same as the first."

ENAMELED STEEL—sold on the efficiency and versatility of RANSBURG Electro-Spray—uses 14 automatic No. 2 Process units to meet the heavy demands of their diversified, high volume production.

NO REASON WHY YOU CAN'T DO IT TOO

Manufacturers—large and small—are reporting similar savings in paint and labor with increased production. If your volume doesn't justify automatic electrostatic equipment, perhaps the RANSBURG electrostatic hand gun will help cut costs in your finishing operation. Write for our new brochure showing actual in-plant production photos, savings figures and detailed information on RANSBURG No. 2 Process Electro-Spray.

RANSBURG

RANSBURG Electro-Coating Corp.

Box 23122, Indianapolis 23, Indiana

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2-Pole Switch Controls Up to Four Circuits

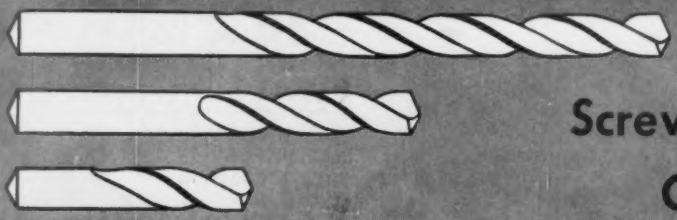
Type AW oil-tight limit switches are now available with a 2-pole, double-throw snap switch which may eliminate the need for a second limit switch or control relay. The new 2-pole switch, which can control up to four circuits, mounts interchangeably with other Type AW limit switches, simplifying installation. Units are offered with a wide selection of operators including push rods, rollers plungers, and roller arms in a variety of lengths and designs. Both flush and surface-mounting devices are available.

Square D Co, Dept SA, 4041 N Richards St, Milwaukee 12, Wis

MORE DATA? Circle 145, inside back cover

PLASMA CUTTING TORCH has a high-velocity, 30,000 F cutting flame that is said to cut conductive metals up to eight times faster than oxyacetylene devices. Quality of cut is high—there is said to be a complete absence of dross from the kerf region. Other features are simple adjustments for cutting different materials, absence of heat up time, and wide tolerance in torch stand-off distance—*Plasmadyne Corp, Subs of Giannini Scientific Co, 3839 S. Main St, Santa Ana, Calif.* •

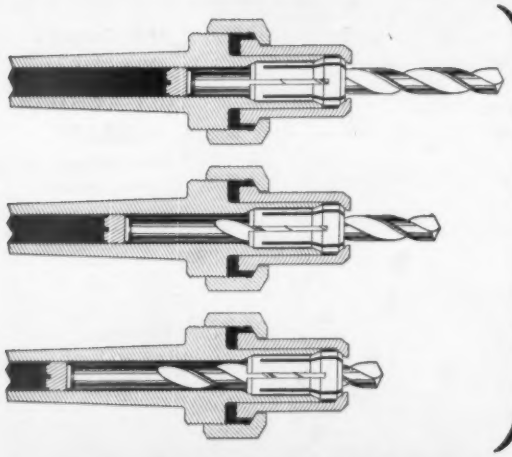
MORE DATA? Circle 146, inside back cover



Jobber's Length
Screw Machine Length
Center Drill Length

WHY BUY ALL THREE?

When a jobber's length drill—held in an ERICKSON COLLET CHUCK —will serve for each!



Simply grip on the flutes*—get any extension you need!

Save tool costs! Why pay a premium for screw-machine length? Why put up with the virtually no regrind life of center-drill length? When you use ERICKSON collet chucks you buy only one drill length—stock only one drill length—and get the regrind bonus of full-length jobbers drills! Three drills for the price of one!

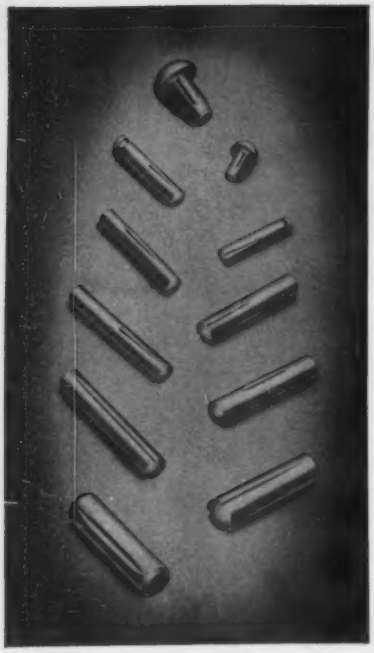
Minimum drill projection means longest tool life, more parts per grind and highest accuracy. Just set inner stop screw to give the projection needed. Use full jobbers length drills, even for center-drilling applications.

* The collets in ERICKSON Collet Chucks are slotted at both ends—collapse evenly over their entire length—grip drills on the flutes to within 0.0005 in. concentricity! You get the long tool-life benefits of short drill projection (as high as 5:1) yet buy only jobber's length drills. Investigate ERICKSON Collet Chucks for your applications. They are available in a wide range of sizes and models, with taper, straight, or special shanks.

The ERICKSON Collet Chuck Manual is free. It lists and describes all models of standard collet chucks. In addition, dozens of special collet chuck designs are shown. It is a storehouse of tooling information and ideas, yours for the asking.

ERICKSON TOOL COMPANY

34350 Solon Road, SOLON, OHIO
(GREATER CLEVELAND)



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Every one of the Groov-Pins shown here was designed with your pin problems in mind. Designed to withstand the rigors of constant shock and vibration without loosening...to drive easily into a simple drilled hole...for faster hand or production feeding, including hopper feed...for a permanent connection that stands up to vibration fatigue as only a solid pin can.

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CORPORATION

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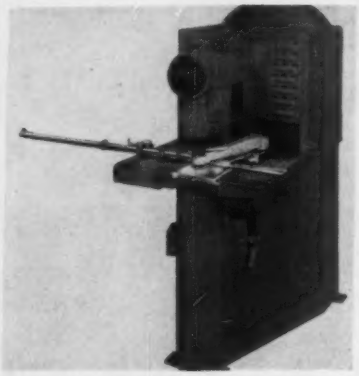
METAL SHOW IN PRINT



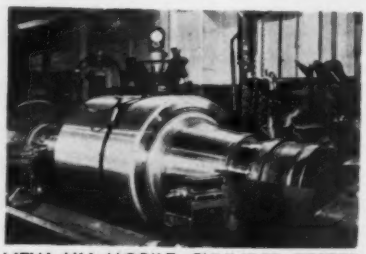
System Makes Fabricator Back, End Gage Settings to 0.001 in.

Micro-set gaging system consists of a 1¼ in. quick-change holder with micro-set gaging that allows an operator to make back and end gage settings directly to thousandths in seconds. Using a chart of X and Y coordinates the operator positions the dial indicator assembly to the nearest inch of the final measurement along the microbar. Then, by moving either the back gage or the work stops along the end gage into contact with the dial indicator carriage the operator can read to the required thousandths on the face of the indicator. Spring loaded indicator carriage and plunger give feel in gage settings and eliminate error since variations are shown on the dial.

The system can be used on any Model 15A, 10AA or 10A Fabricator without any special rework to the machine.

Wales Strippit, Inc, a Unit of Houdaille Industries, Inc, 200 S Buell Rd, Akron, NY

MORE DATA? Circle 189, inside back cover

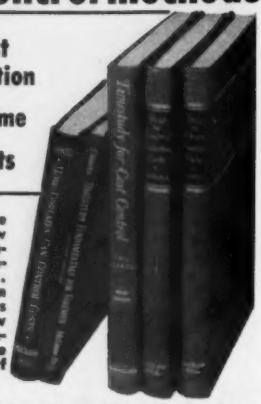


NEW MV MOBILE CYLINDER TESTER can be brought to workpieces having diameters from 12 to 36 in. Mobile tester is part of company display which includes the JS and the 5 JS, the smallest and tallest Rockwell superficial testers — *Wilson Mechanical Instrument Div, American Chain & Cable Co, Inc, 230 Park Ave, New York, NY* •

MORE DATA? Circle 190, inside back cover

How to use expert cost control methods

- to boost production
- save time
- cut costs



A-to-Z course shows you how to install or improve cost control methods... what foremen and supervisors can do... how to make timestudies do twice as much for half the cost.

An expert on the subject, Phil Carroll, shows you exactly how to take on cost control problems —and solve them—at all levels in the plant or shop. Foremen, supervisors, engineers, timestudy men—all can use these specific facts, data, and methods to get on top of cost problems in quick order.

Starting right at the front-line supervisory level, this Library gives scores of helpful tips on such typical foreman cost problems as changing setups, training new men, handling rush orders, eliminating waiting time, scrap, and so on. You get ABC's of timestudy . . . step-by-step explanations of standard-setting processes . . . complete, practical details of entire timestudy procedure like how and where to start, building standard data, maintaining a complete incentive installation . . . and tested means of boosting profit and plugging cost leaks through the total-conversion-cost method of control.

Phil Carroll's
PRACTICAL COST CONTROL LIBRARY
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With the help of this Library you can take action on all 3 of the basic elements of cost control — make it really work for you. You see how to establish and check work standards . . . how to pick best incentives . . . how to get personnel to correct lost and wasted time. The Library shows you how to increase productive time of men and machines with methods and procedures that have proved successful. What's more, you can apply timestudy methods described here without disrupting your plant to create special conditions.

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Bought separately you'd pay $28.70 for these 5 volumes by Carroll: *How Foremen Can Control Costs; Timestudy Fundamentals for Foremen, 2nd ed.; Timestudy for Cost Control, 3rd ed.; How to Control Production Costs, and How to Chart Data.*

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To withstand the terrific strain of metal-machining, a lathe must be rugged—*real* rugged. Logan lathes are.

Solidly built headstock features large oversize spindle and ball bearings. Rugged carriage has double-walled apron, large tool post, and heavy-duty compound rest assembly. Extra-heavy duty tailstock provides rigid support for work.

Wide, machine-cut change gears are characteristic of Logan lathes. Made of "Ductile Iron", they have triple the strength of case iron gears, and tensile strength superior to most steel change gears.

The 10" x 56" lathe bed is another example of Logan ruggedness. Oversize ribs and balanced sections of even thickness effectively neutralize internal stresses.

rugged

Lathe's capacity (14⅝" swing over bed, 9" swing over saddle, and 28" center distance) combined with ball bearing variable speed drive of 40-1400 rpm (no stopping to shift belts), makes Logan the best dollar value in the lathe field. Complete information on request.

Model 6510
$1,775.00
F.O.B. factory

Logan

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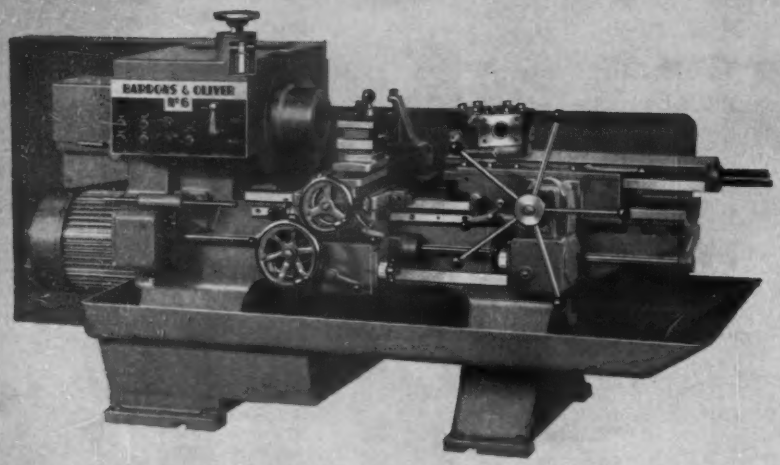
4901 W. Lawrence Ave., Chicago 30, Ill.



RAM TYPE TURRET LATHES		
Size	Bar Capacity	Swing Over Bed
No. 2 Geared Electric	1″ or 1¼″	13½″
No. 3 Universal	1½″ or 2″	15½″
No. 4 Universal	2″ or 2½″	18¼″
No. 6 Universal	3″ or 5″	21⅛″
SADDLE TYPE TURRET LATHE		
No. 21 Universal	3″ or 4½″	21¼″

BARDONS & OLIVER

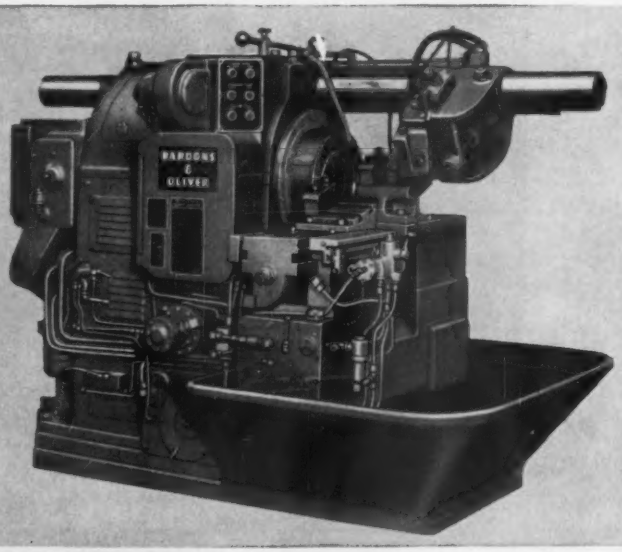
Turret Lathes . . . .

Each of the five Turret Lathes listed is a completely different machine, designed specifically for one range of work. All units on each machine, including the cross slide and carriage, and the turret slide and saddle, are "sized" for a particular work range. Thus adequate strength and rigidity is provided, maximum productive capacity is offered, and at the same time minimum operator effort is required. A complete line of tooling and attachments is available for each size of machine.

Cutting-Off Lathes

The Cutting-Off Lathes are designed to chamfer, form and cut off pipe, tubing, or bar stock with maximum efficiency. The number of pieces produced per hour often equals or exceeds that of much more expensive and complicated multiple spindle machines. Automatic loading tables, chamfer attachments, forming attachments, and automatic unloading devices are available for all sizes of Cutting-Off Lathes. These lathes are built as fully automatic, semi-automatic or hand operated.

CUTTING-OFF LATHES	
Size	Capacity
No. 32	2″
No. 33 and 34	3″ and 4″
No. 35 and 36	5½″ and 6⅝″
No. 38 and 39	8⅝″ and 9⅝″
No. 312 and 314	12¾″ and 14½″
No. 316	16″



BARDONS & OLIVER

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

CIRCLE 402 READER SERVICE CARD

Udylite Corp to Merge With Metal & Thermit

Udylite Corp of Detroit will become a major division of Metal & Thermit Corp of New York when stockholders of both companies approve a formal merger sometime in December. Move strengthens the plating businesses of both firms combining some $6 million in plating (out of a $40 million total business) by Metal & Thermit last year (primarily chromium and tin plating) with almost all of Udylite's last year's business of $37.5 million, mainly in nickel and cadmium plating.

Reasons for the merger include Udylite's recent move toward diversification and M&T's need for strength in plating. Combination will produce the strongest plating firm in the country, marketing materials, equipment, and licensed processes to many phases of metalworking, including automotive.

Pratt & Whitney Aircraft Sets Up Advanced Materials Lab

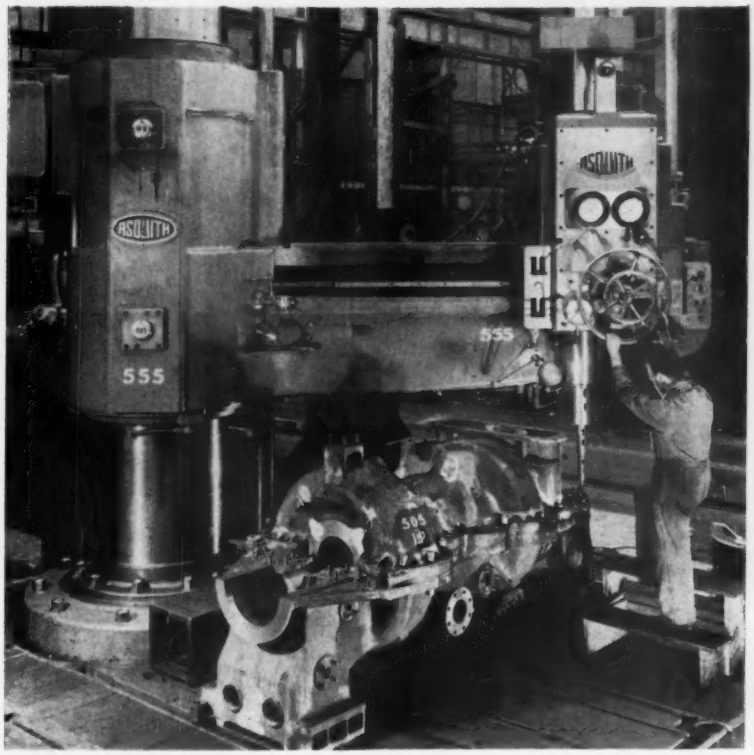
A special facility to develop new materials for aircraft, space, and industrial powerplants of the future has been established by Pratt & Whitney Aircraft division of United Aircraft Corp. The new Advanced Materials Research and Development Laboratory, located in the North Haven, Conn, plant of P&WA, will be directed by Dr Maurice E Shank, former associate professor of the department of mechanical engineering at MIT.

Principal goals of the lab will be development of high-strength materials, alloys for service at extreme temperatures, and materials for energy conversion devices. New materials will be sought for a wide spectrum of powerplants, including rocket and aircraft jet systems as well as marine and industrial engines.

Detroit Broach to Supply Machines For Army Ordnance

Detroit Broach & Machine Co, Rochester, Mich, is the successful bidder on a $200,000 order for replacement machine tools at Springfield Armory, Springfield, Mass. Contract calls for four new 25-ton vertical dual-ram 66-in. stroke broaching machines for broach-machining components of the Army's newest rifle.

Included in the order are fixtures, broach holders, and cutters to test run all eight rams of the machines prior to shipment. Basically, all machines are designed along Detroit Broach standards, modified only to meet Army specifications.



Holes are being drilled in the joint of a high-pressure turbine casing at Parsons Marine Turbine Co Ltd, Wallsend-on-Tyne, England. Great Britain pioneered the development of the steam turbine engine for ships. Advances in welding techniques have made it possible for vessels to be constructed in large units, prefabricated under cover, and rapidly assembled for launching. More than $280 million has been spent since 1946 on modernizing and mechanizing shipyards including construction of berths for building oil tankers of up to 100,000 tons

Douglas Plans to Close El Segundo Plant

Douglas Aircraft Co is negotiating with the Navy for authorization to close the El Segundo plant which is largely Navy-owned and which produces the Navy's A4D attack aircraft. This work would be transferred to the Long Beach and Torrance plants, part of Douglas' new Aircraft Division.

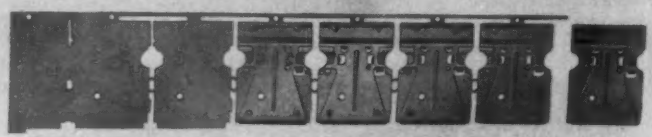
Closing of the plant will require a layoff of about 1650 persons there but a net loss in southern California employment of less than 250. Total employment at what has hitherto been called the El Segundo Division, including plants at El Segundo, Torrance, and Palmdale, is now 7800. Of this number it will be necessary to lay off approximately 1650, which means 79% of the persons employed in the division will continue to have jobs. Net effect in the southern California area, however, will be a loss of less than 250 jobs since it is proposed to rehire more than 1400 at Long Beach. Of the total number of approximately 5500 salaried and hourly personnel at the plant in El Segundo, about 2600 will be transferred to Long Beach and 1300 to Torrance.

Decision to close one of Douglas' major West Coast plants, according to Jackson R McGowen, vice president and general manager of the Air-

B. Jahn

PROGRESSIVE DIES produce complex camera side panels at 65 per minute!

Camera side panel. 8 station progressive die. 65 pieces per minute—.025" steel.



Camera side panel. 7 station progressive die. 65 pieces per minute—.025" steel.

Dozens of different precision piercing, blanking, bending and forming operations are performed every second . . . one press, one die instead of many.

The savings in floor space, press capacity, materials handling and man hours is hard to estimate. B. Jahn design, ingenuity and precision progressive dies are eliminating unnecessary, costly press operations and contributing toward efficient economical production and improved product quality daily.

Why don't you find out how much B. Jahn Dies can improve profits in your press department?

B. Jahn

Write for Brochure

THE B. JAHN MANUFACTURING COMPANY
CHERRY & ELLIS STREETS • NEW BRITAIN, CONNECTICUT

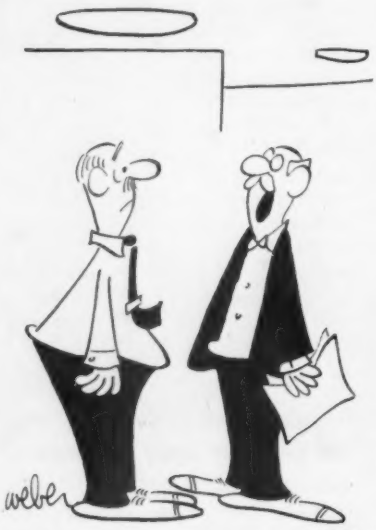
craft Division, was the inevitable result of a downward trend in aircraft production that has affected the entire industry and has already caused substantial layoffs by Douglas in recent years. If the Navy approves, the move from El Segundo will begin this month and completion will require a period of months, according to reports.

Ingalls Ship Gets Big Order

A $24.4 million Navy contract has been received by Ingalls Shipbuilding Corp at Pascagoula, Miss, for construction of a new type of submarine tender. The tender will provide facilities and support for the nuclear-powered Polaris-firing craft.

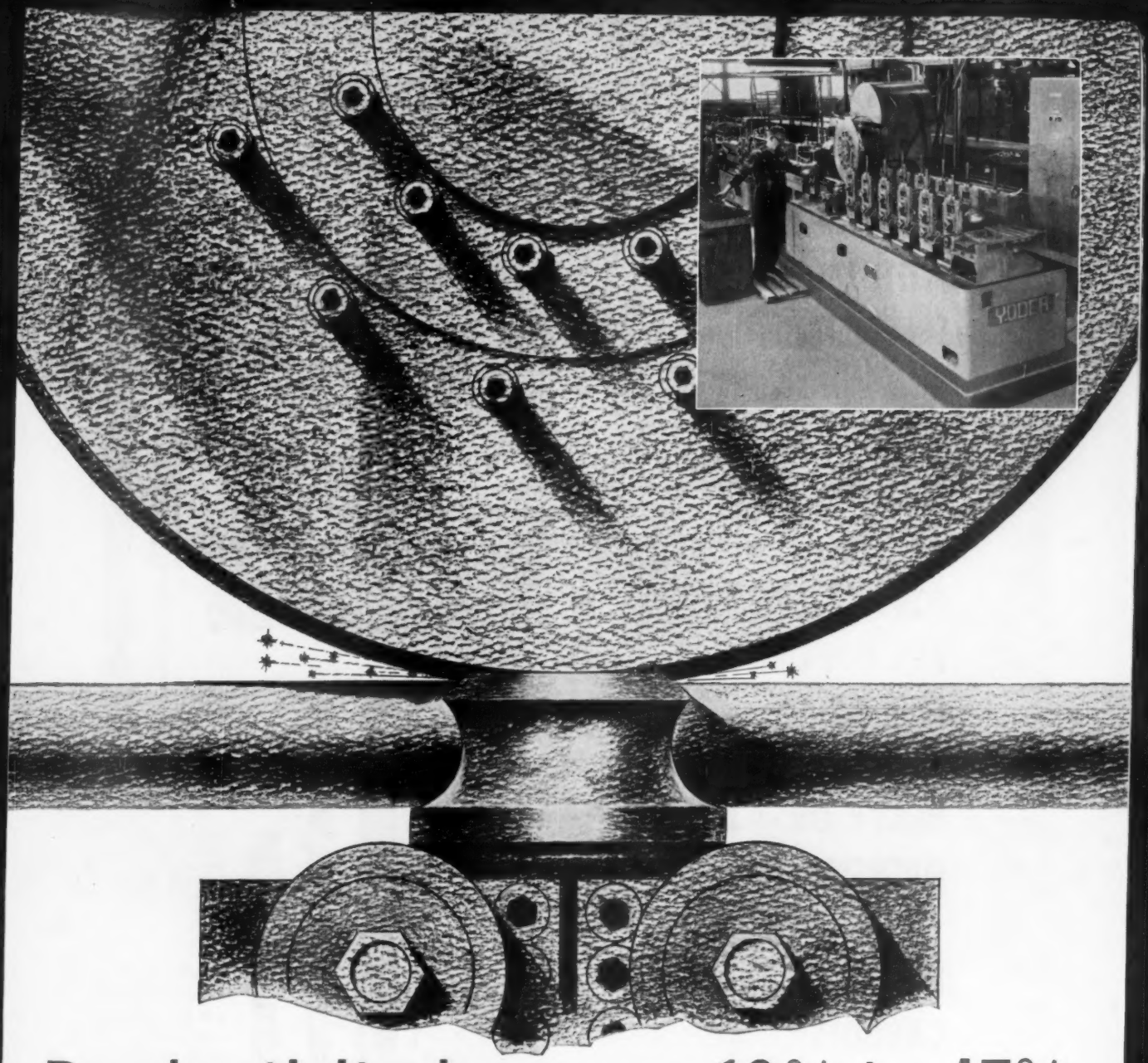
New Sparton Contracts Upping Employment

Sparton Electronics, division of Sparton Corp, has been awarded military electronics contracts totaling $14.5 million. New orders raise the company's backlog in this field to $25 million and total corporate backlog to $34 million. Contracts will result in the creation of 400 new jobs, raising total employment for the Jackson, Mich, plant to more than 1000. Approximately 50% of the contracts will be sublet with much of the work going to central Michigan subcontractors.



AM/MM

"You have no need to worry about being replaced by a machine, Buxton—it would be foolish to invent one that does absolutely nothing."



Productivity Increase 19% to 47%

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"TYPE V" PIPE AND TUBE WELDER . . . VAPOR COOLED!

Thousands of hours of tests and actual production point up the major productivity increases achieved by the new Yoder "Type V" Welder. The new Welder is available as a replacement unit for existing equipment or as an original component of a new Yoder pipe or tube mill.

The advanced design and engineering of the Yoder "Type V" Welder is described in a new brochure. This valuable information can be yours by return mail. Send the coupon at the right . . . today!

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FIELD REPORT

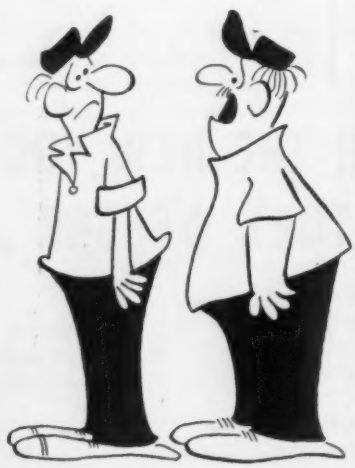
Martin Steps Up Bullpup Work

A $17 million contract awarded by the Air Force and Navy to Martin Co's Orlando, Fla, Division provides for accelerated production of the conventional warhead version of the Bullpup air-to-surface missile. The Division will put its Bullpup line on a two-shift basis for the first time in the project's history. Exact number of missiles to be produced is classified, but the new production schedule will allow more Air Force and Navy squadrons to be armed with them sooner than expected.

Netherlands Metals Firm To Produce Hydrometals Alloy

Lips N V, major non-ferrous metal fabricator of the Netherlands, will begin production and sales of Hydro-T-Metal, the new alloy of titanium, copper, and zinc developed by Hydrometals Inc, New York, which will provide technical and marketing assistance and receive royalties under the contract with Lips.

Lips will alloy, cast, and process Hydro-T-Metal under license at Drunen and sell the patented product in a wide variety of forms throughout the Netherlands, Belgium, and Luxembourg as well as in 12 countries outside the Benelux area. The Dutch company has expanded ten-fold since the war and now covers more than 35 acres; employment is over 1300.



AM/MM

"The boss must be heading this way—I can feel the tension mounting."

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NEW YORK TWIST DRILL
manufactures
TAPER SHANK DRILLS

extra tough and true too!

All regular series to 3½" O.D. available for immediate delivery —Specials made up to 1⅛" O.D.

New York Taper Shank Drills save you 25% on your twist drill bill — as do all the drills in our extensive line. If you wish further information, one of our sales engineers will be glad to call on you.

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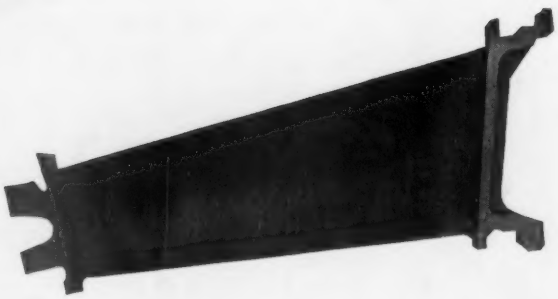
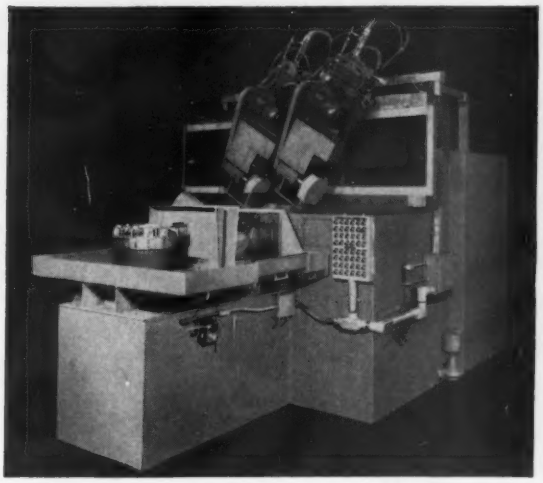
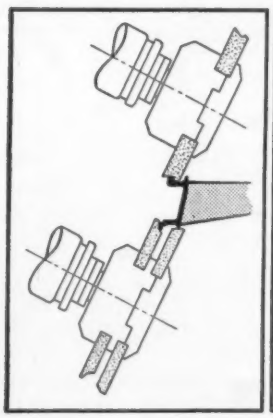


Vertical grinding 19 surfaces efficiently

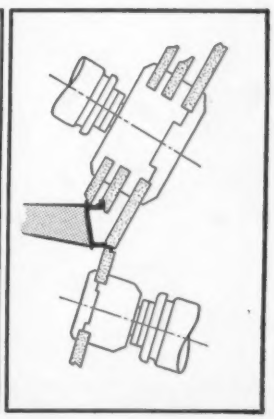
Turbine blades for jet engines require such precise accuracy and smooth finish on so many surfaces that the only economical way to grind them in large quantities is *vertically*. In vertical grinding, whether on standard machines or complex specials, gravity works directly for you. The machine does not have to overcome gravity—the result is simplified fixturing and efficient, highly accurate indexing. Single or multiple grinding heads advance to difficult surfaces, grind, then retract for automatic dressing and size control as a new piece is indexed.



Vertical production grinder shown above is typical of Springfield four-head machines in jet engine plants. An upper and lower head are located at each station. Station operations are shown below.



Left station — 7 surfaces ground in one pass.

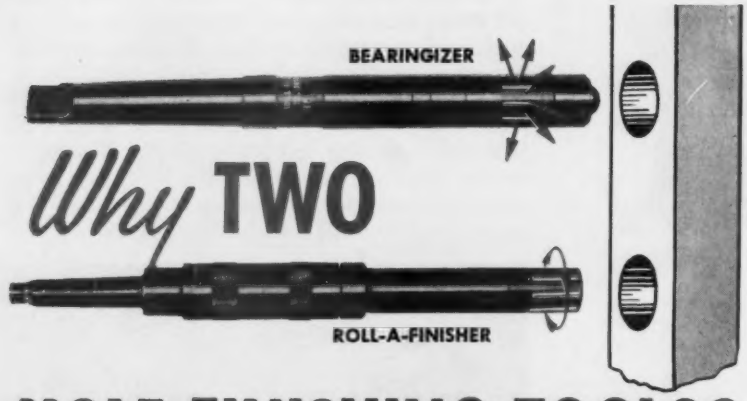


Right station — 12 surfaces ground in one pass.

When high production and accuracy dictate your grinding requirements, it will pay you to investigate the Springfield principle of vertical grinding. The pay-off is also in floor space savings and in the fact that heads usually can be repositioned when part requirements change.

If you would like to know more about the vertical grinding principle, please send for our Bulletin 197-C. The Springfield Machine Tool Company, Springfield, O.

SPRINGFIELD



Why TWO HOLE FINISHING TOOLS?

For fine surface finishing (2-10 microinches) either tool will give excellent results. They differ in *speed*, final *accuracy*, *what* hole preparation is required and the *degree* of hardness achieved.

	BEARINGIZER	ROLL-A-FINISHER
speed	150 ipm	20-50 ipm
accuracy	low tenths	some improvement over hole preparation
work preparation required	close preparation because of limited ductility of materials under cold forging	rough bored hole
surface hardness	increased 10-30%	increased 5-10%
tool wear	compensated by replacing rolls	compensated by simple adjustment
thin wall structures	special fast rise cam construction maintains roundness	creates out-of-round conditions

Your local Cogsdill engineering representative will be glad to recommend the proper tool for you and will work with your staff to insure proper use and performance.

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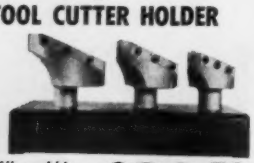
FLY-TOOL CUTTER HOLDER



3 convenient sizes with 3/4" shank and stand used with 5/16" carbide or high speed tool bits. Will machine up to 6" wide surface. NEW counterbalanced model allows faster speeds and feeds. Made of steel—hardened. Save on expensive end mills and sharpening cost. Better finishes. Write for Bulletin.

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FIELD REPORT

Contractor's Team Chosen for Tri-Service VTOL Transport

Army, Navy, and Air Force have agreed to a tri-service program for development and manufacture of an experimental tilt-wing VTOL transport aircraft. Air Force will have management responsibility and the contractor team of Vought-Hiller-Ryan will do the work. Entire program, which may cost over $70 million, would cover fabrication of five transport aircraft.

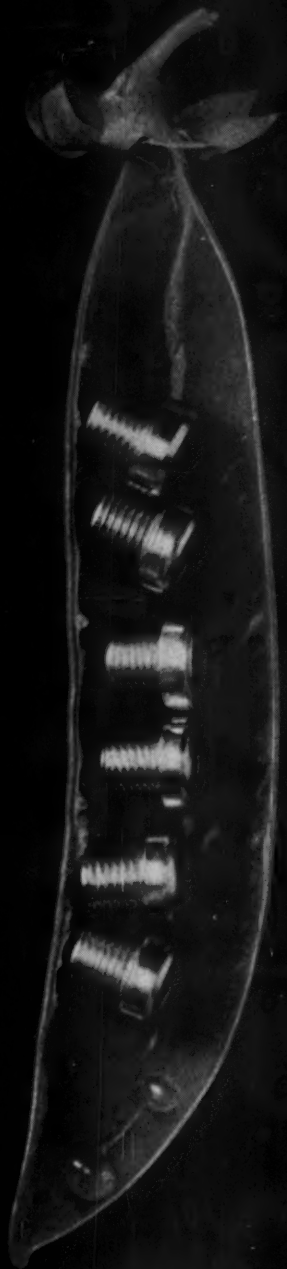
In addition to this program, the services are considering a supplementary research study to evaluate more advanced concepts of VTOL aircraft based on designs submitted. If one or more additional configurations is selected for further development, the total program amount may exceed $100 million.

Robbins & Myers Forms New Division

The Airtrol Division has been established by Robbins & Myers, Springfield, Ohio, manufacturer of materials handling equipment. Airtrol will specialize in the design, production, and marketing of unit type collectors for control of dusts and mists in industrial operations. New machinery and production facilities for the division are currently being set up in Springfield for early fall production schedules.

AM/MM

"Now we know why no ideas ever came out of this department. Nobody works here."



Micro-Chip is all alike!

It's consistent. Like peas in a pod . . . parts made of Micro-Chip are all alike. Kaiser Aluminum's new 2011-T3 consistently delivers small chips . . . faster machining . . . minimum tool resetting . . . uniform machinability throughout every bar, from bar to bar and lot to lot. Call your Kaiser Aluminum Distributor for "Micro-Chip" 2011-T3.

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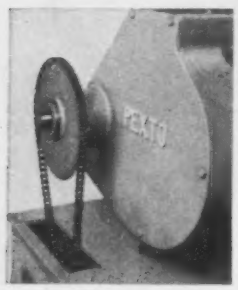
PEXTO SLIP ROLL FORMING MACHINES

Maintain Constant Efficiency with Positive CHAIN DRIVE



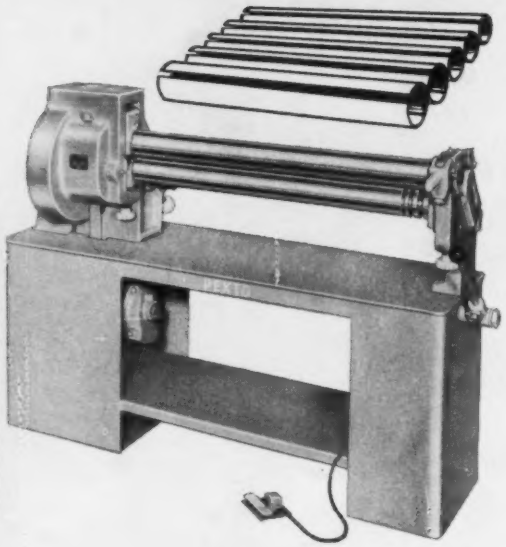
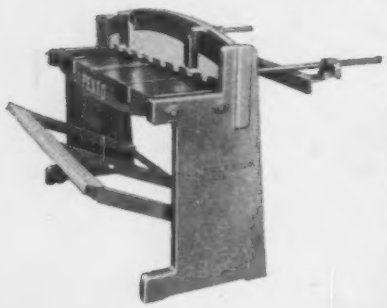


Illustration shows chain drive with guard removed.

PEXTO makes a complete line of reliable machines and tools for sheet metal fabrication. The Slip Roll, illustrated above, with new chain drive provides positive power at the roll. PEXTO Power Squaring Shears, Foot Shears, Brakes, and a complete line of Hand Tools have, for more than a century, been the standard of quality.



A complete line of Foot and Power Shears, built for accurate, fast shearing. PEXTO Shears are designed to operate at continuous full-rated capacity.

Now . . . the **Ideal** Box and Pan Brake for laboratories, mock-up work and the precise duplication of small parts. It is rugged and attractively priced.

PEXTO Machines are sold through Dealers and Distributors . . . Send for Catalog 159.

THE PECK, STOW & WILCOX CO. Southington, Conn., U.S.A.

A complete line of machines and tools for Sheet Metal Fabrication . . . Since 1785

FIELD REPORT

Army Order to Hiller

Hiller Aircraft Corp, Palo Alto, Calif, has received a $6.7 million contract to supply light observation helicopters for the Army. Largest single peacetime order for military helicopters, contract calls for delivery of the H-23-D models to start in January. Company, which has supplied several hundred of this model to the military in the past few years, plans a substantial expansion of its present labor force of 900.

GM Diesel to Close

Cleveland Diesel Engine Division, which employed 5000 during wartime, will be closed by General Motors Corp before year's end. Activity at the plant has been on the wane for the last few years and current employment is about 500. There is some talk about consolidation of the division with the Electro-Motive Division in La Grange, Ill. Both parallel each other in the horsepower range of diesel manufacture. Most of the Cleveland Diesel employees will be transferred to other GM facilities.

Lockheed-Georgia Co . . .

. . . Marietta, has been awarded a $10.6 million Navy contract for additional GV-1 aerial refueling-combat transports. The GV-1 is the long-range version of Lockheed's Hercules B model and performs air-to-air refueling of marine jet fighter and attack aircraft and combat transport duties.

AM/MM

"Expecting your wife to come in and pick up after you?"

NIKON OPTICAL COMPARATOR

new model 3A offers unusual screen brightness and image resolution – features zoom-condenser system

The unusual image brightness, definition and accuracy achieved in the new model 3A—to the very edge of the screen—is a credit to the quality and design of its optical system.

The new Nikon model 3A permits surface as well as contour inspection—independently or simultaneously. And controls are provided for adjusting the intensity of each of the illuminators.

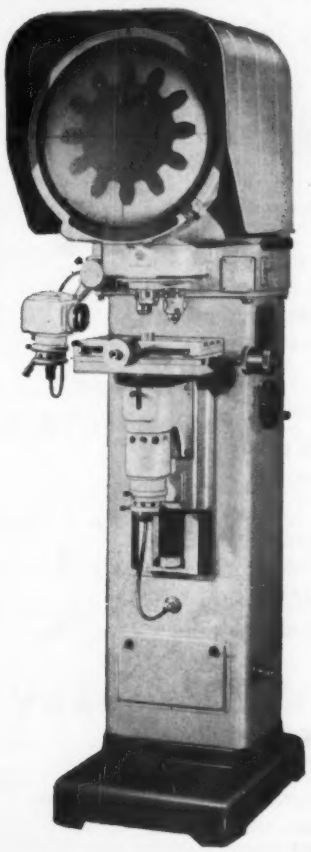
The surface illuminator may be used obliquely to emphasize surface texture. Or, for greater measurement accuracy, the surface illuminator may be used in conjunction with lens-mounted, half-reflecting 45° angle mirrors to provide shadowless light on the optical axis. Contour illuminator employs a special zoom condenser matching system. Convenient control simplifies adjustment for optimum illumination at each magnification.

Model 3A is normally supplied with a choice of one or more standard lenses in magnifications ranging from 10x to 100x. Other magnifications are also available on special order. A 3-lens turret supplied as standard equipment, facilitates instant changes. Focusing is smooth and effortless. Utilizes leadscrew drive with scraped ways and adjustable gibs.

The model 3A is equipped with a sliding hood which may be drawn out to shade the screen, or can be retracted to permit ready access to chart or screen surface. The overall diameter of the screen glass is 14½", designed for use with standard charts.

The new Nikon 3A accepts a wide variety of micrometer stages, holding fixtures, protractor screens, charts, photo attachments, and other accessories. For details write to Dept AM-10

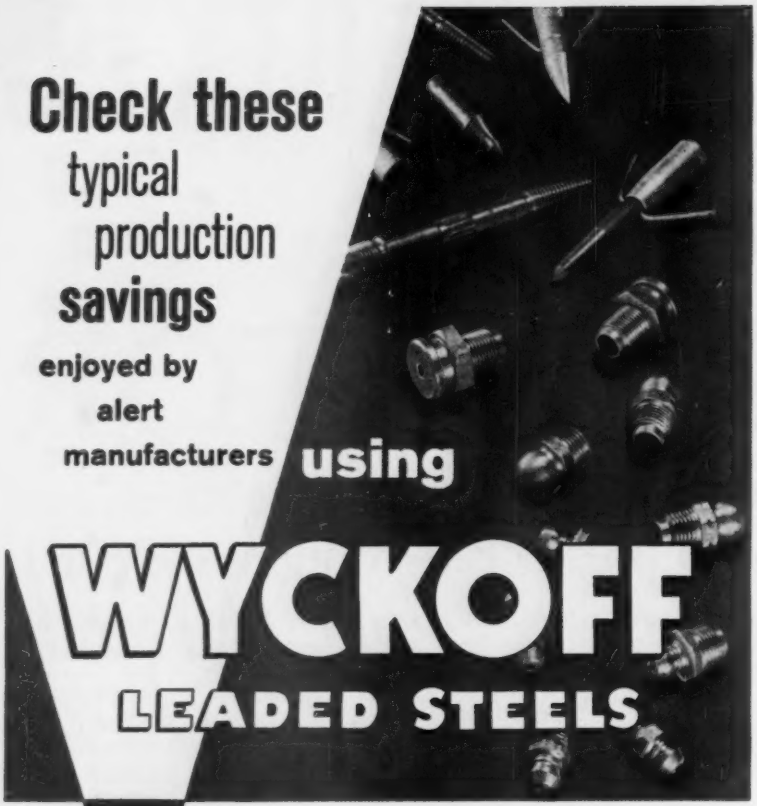
features new 14" screen



NIKON INCORPORATED Instrument Division 111 Fifth Avenue New York 3, N. Y.

Check these typical production savings

enjoyed by alert manufacturers using



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Bell & Howell Sets Up English Subsidiary

An electronics subsidiary near London which will assemble and manufacture data processing equipment and market this instrumentation throughout the United Kingdom has been established by Bell & Howell Co, Chicago.

New company, to be known as Consolidated Electrodynamics Corp (UK) Ltd, will market the entire line of data processing instruments produced by Consolidated Electrodynamics Corp, B&H subsidiary in Pasadena, Calif. Products include a family of transducers, all types of magnetic-tape recording and reproducing equipment, and an extensive line of recording oscillographs.

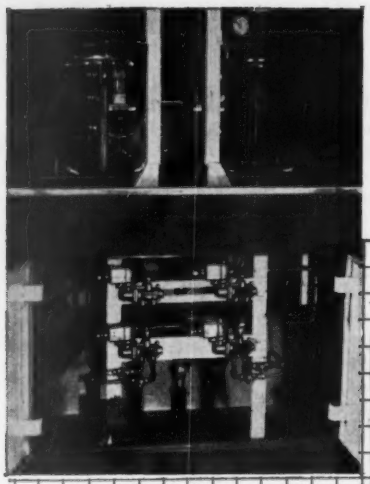
FMC Hires More Workers

FMC Corp is hiring several hundred new employees at its San Jose, Calif, operations to keep pace with its latest Army order for M113 armored personnel carriers. Contract for the FMC-designed vehicles, termed "urgently needed" by the Army, calls for delivery by next June.

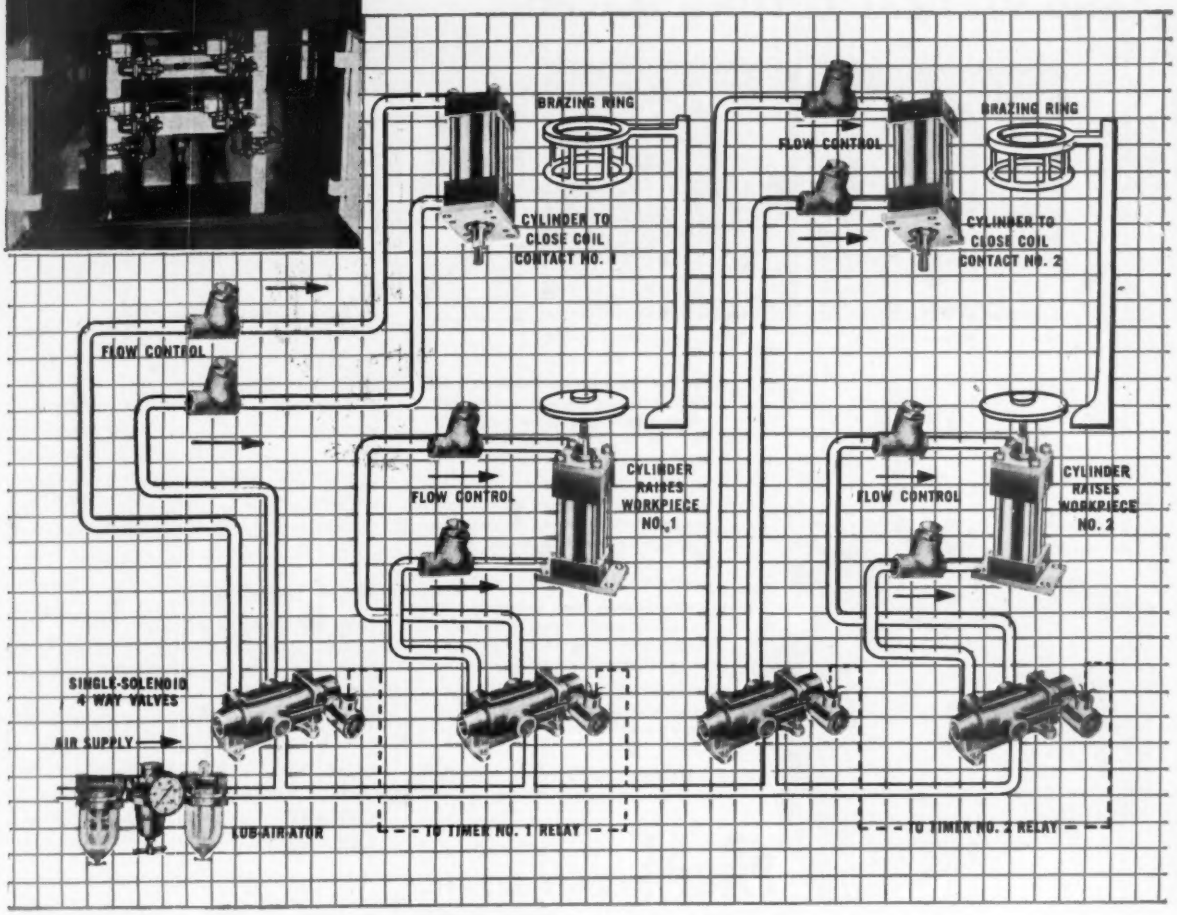
Although the Army has not disclosed the dollar value of the new order, the company is currently operating on a $40 million contract that calls for 1500 M113s for June delivery. This order, received last March, made a total of some $115 million in orders to the firm for the vehicle. In order to meet delivery requirements, FMC will accelerate its production schedule by 50%.

AM/MM

"Remember those good old days when all we had to do was set up the machine, make all the adjustments and check the piece constantly?"



General Electric Company's Apparatus Service Shop in Detroit, Mich., uses Schrader air circuits to actuate and control this brazing machine. It enables one man to braze 120 planet carrier gear assemblies for automotive transmissions in one hour. Double-acting cylinders, actuated by solenoid valves, lift the assembly into position within the coil for brazing the shaft to the gear, and lower it for water quench. JIC cylinders control the induction heating coil contacts. According to Frank A. Ross, the designer, Schrader's Flow Control Valves close contacts so gently that they perform 750,000 cycles before needing replacement. In addition, air works successfully in a strong magnetic field, and the circuits can be simple.



TOUGH BRAZING JOB BECOMES A BREEZE... WITH SCHRADER AIR CIRCUITRY

PROBLEM: Strong magnetic field . . . complex movement of parts . . . speed requirements . . . precise actuation of coil contacts.

SOLUTION: Simple Schrader air control of mass production operations.

Schrader Air Products are designed to operate together in varied combinations to produce practically unlimited results. Their quality and versatility make them capable of *simplifying* production . . . while speeding it up . . . at unmatched low cost. Are you failing to ultilize fully the air you already have? Follow this Detroit plant's example. Examine your production facilities with air in mind. Make many operations simpler and more efficient by applying any or all of the complete line of Schrader Air Control Products.

This new Schrader catalog is available at your Schrader distributor, who is stocked with the complete range of sizes and types of Schrader air circuitry products. Consult the Yellow Pages or write Schrader.

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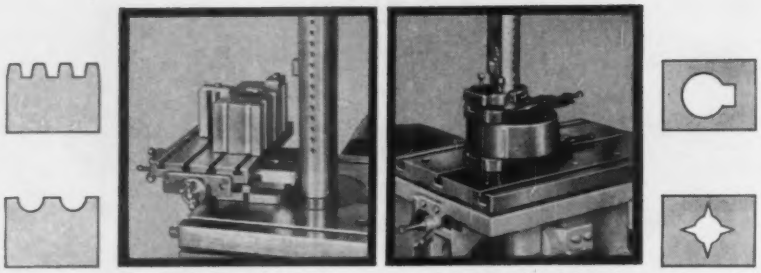
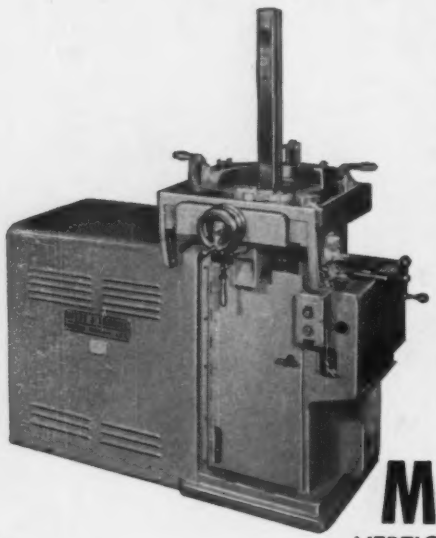
QUALITY AIR CONTROL PRODUCTS

PERFORM SPECIAL PRODUCTION JOBS ON HYDRAULIC M&M KEYSEATER AND VERTICAL CUTTING MACHINE



Set-up for external cutting

Set-up for internal cutting



The new Mitts & Merrill Keyseater and Vertical Cutting Machine can be easily adapted to cutting splines, serrations and die profiles both internal and external, by adding simple fixtures.

With combination tilting table and index table, straight or tapered bores and accurately spaced multiple keyways or splines may be cut at any degree of the circle, with internal keyways up to 3" wide x 24" long.

Hydraulic drive gives smooth performance and faster machining; stroke and feed as well as tool relief are automatic, assuring exceptional accuracy.

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Rohr Shares in Lockheed Order

As a result of the $92.7 million prime contract to Lockheed-California Co for production of P3V-1 Orion anti-submarine warfare aircraft, Rohr Aircraft Corp, Chula Vista, has received subcontract add-on orders from Lockheed to supply major powerplant and other components for the aircraft. Newest order will extend the company's Chula Vista main plant P3V production into mid-June 1963. Deliveries will be made to Lockheed's Burbank plant, handling assembly of the P3V-1 for the Navy.

Miami Shipbuilding Sold

A Washington attorney, C Leo D'Orsey, has purchased Miami Shipbuilding Corp. The plant, which has been in operation since 1929, reportedly includes one of the finest machine shops in the South. Miami Ship has a contract with Lycoming Corp to experiment with hydrofoils for the Navy.

Howe Sound Forms International Division

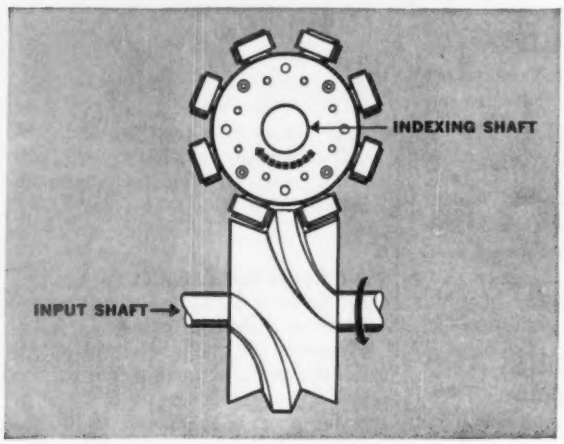
Howe Sound Co, New York metals manufacturer, has established a new overseas division, Howe Sound International Inc. The new corporation, which has been incorporated in Liberia, will handle expanding activities in foreign markets now being conducted by many divisions of Howe. The international division will

AM/MM

"I always feel a little foolish discussing our retirement plans with 18-year-olds."

How Ferguson *ELIMINATES BACKLASH* in Index Tables

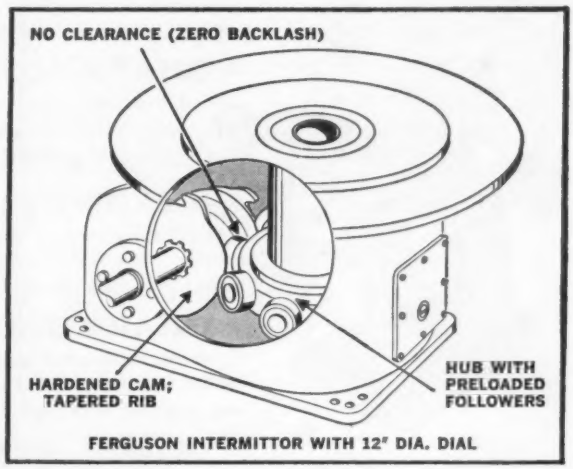
Backlash in indexing results in shock loads that affect the efficiency of a machine and the quality of its product. Most indexing mechanisms have inherent characteristics that cause backlash and poor dynamic conditions and prevent the designer from taking full advantage of modern feeds, tooling and methods that contribute to production economy.



Ferguson Intermittor Index Tables have inherent zero backlash and extreme precision which results in a rotary transfer machine base capable of operating speeds up to 500 indexes a minute. *A Ferguson index table never proves to be a limiting factor in the speed or performance of an automatic assembly machine.*

HERE'S WHY: The continuously rotating cam of a Ferguson indexing mechanism features a *tapered rib* along which two preloaded bearing followers roll, maintaining constant contact with no clearance between them and the rib. When the mechanism is in the rest, or dwell, position, a straight portion of the rib locks the followers with zero backlash and an indexing accuracy of .001". Wear on the hardened tool steel cam is infinitesimal (many have been in use for more than 25 years). Followers are rated for a minimum of 8,000 hours operation. If backlash occurs after this period the life of the drive may be renewed merely by replacing the standard followers.

NOTE HOW PRELOADED FOLLOWERS ENGAGE RIB



FERGUSON INTERMITTOR WITH 12" DIA. DIAL

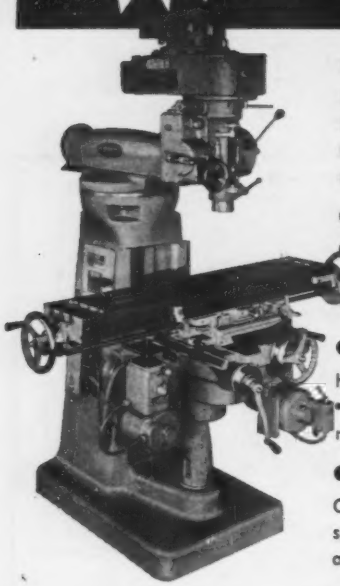
Compare this with other types of indexing devices. A geneva drive, with its slotted wheel and driver, and a barrel cam with a grooved track which engages one follower at a time, must have clearance in the slot or groove to allow passage of the follower. The slightest amount of clearance causes backlash. As the slot or groove wears, the clearance becomes greater and the backlash condition worsens. At the higher, more profitable operating speeds poor dynamics cause wear on other parts of the machine. The user must choose between frequent downtime for repairs or slower speeds . . . He is the loser in either case.

FREE DESIGN DATA — Load ratings, dimensions and application and installation information about standard and stock Intermittors, Ferguson Drives and in-line machines are contained in a single 36 page catalog. Every designer should have one in his library . . . Write Ferguson—Ask for Catalog No. 160.

FERGUSON
MACHINE COMPANY
A Division of Universal Match Corporation
7818 Maplewood Court • St. Louis 17, Missouri

NEW

"645" BETTER SIX WAYS



• GREATER RANGE—
In EVERY category than ANY machine in its class • 25½" of ram travel • Spindle to table and spindle to column—Range greatly exceeds competitive machines, PLUS many other dimension advantages.

• GREATER ACCURACY—
Ground lead screws • Hand scraped ways • Overarm stays in one plane • Locks without distortion • Tool room accuracy in manufacture of components.

• GREATER VERSATILITY—
Head tilts 45° forward and back, rotates 360° on ram • Turret rotates 360° on column • Power assembly rotates 360° around spindle • Many other features.

• GREATER EFFICIENCY—
Convenient controls • 9 spindle speeds, 3 power spindle feeds (up or down) • 4-way head handles any compound work angle • Greater work area.

• GREATER DURABILITY—
Index quality throughout for long trouble-free life.

• PROVEN ACCESSORIES AND EXTRA EQUIPMENT—
Ask for catalog and prices.

WRITE FOR YOUR COPIES OF 4-PAGE DESCRIPTIVE BROCHURES PACKED WITH FACTS ON NEW MODEL "645" HEAVY DUTY "55" VERTICAL MILL AND MODEL "60" HORIZONTAL MILL.

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American Machinist/ Metalworking Manufacturing
New York 36, N. Y.

have an active operating plant, Austenal-Europa, a dental laboratory located in Cologne, Germany. In addition, Misco Precision Casting Co, a Howe division, has active licensees operating under its Mono-Shell investment casting process in Germany, France, and Italy.

Elastic Nut Division To Be Merged into Fairco

Joint venture arrangement has been reached by Elastic Stop Nut Corp of America with Fairco Industries Inc of Gardena, Calif, whereby the assets and facilities of the Aircraft Bolt Co division of ESNA will be merged into Fairco. New company will be known as ABC-Fairco Inc.

Both companies are suppliers of fasteners to Convair and other airspace industries. Integration of Fairco plants and product lines in Gardena with ABC's facilities and production in Monterey Park, Calif, will make available a single source of fastener supply.

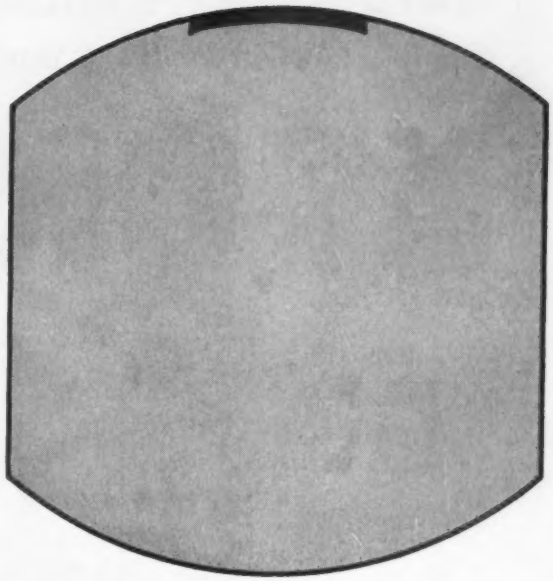
Air Reduction Expands in Calif

Air Reduction Pacific Co, major producer of industrial gases and welding products, and a division of Air Reduction Co, is starting construction on a major expansion of its air separation plant in Richmond, Calif. Enlarged facilities will more than double the present production, increasing total output of liquid oxygen, nitrogen, and argon to approximately

AM/MM

"I was standing too close to the time-clock at five o'clock."

NEW: Now, SKF's improved "C" type design extends contact area over the entire length of a longer roller element.



OLD: In older flanged type bearings, effective contact area was no longer than the red line.

CAPACITY:

SKF's new "C" type bearing increases capacity as much as 54% by giving the roller some growing space.

The space was always there, but, until the SKF "C" type bearing, it was occupied by undercuts and fixed flanges. SKF removed them so the roller could be lengthened over a wider raceway.

Result: *The SKF "C" type bearing increases capacity up to 54%—corresponding to more than 4 times longer service life.*

SKF PUT THE GREATER LENGTH TO WORK. Length alone is not enough. It's only the raw potential for greater load-carrying capacity. A high capacity bearing has to be designed to *realize* that potential. Here's how the "C" type does it:

- CLOSE OSCULATION, that is close conformity between rings and rollers, distributes load evenly over the *entire* length of the roller.
- AN AXIALLY FLOATING FLANGE, combined with the symmetrical roller, assures automatic and *even* distribution of load under any combination of radial and thrust loads.

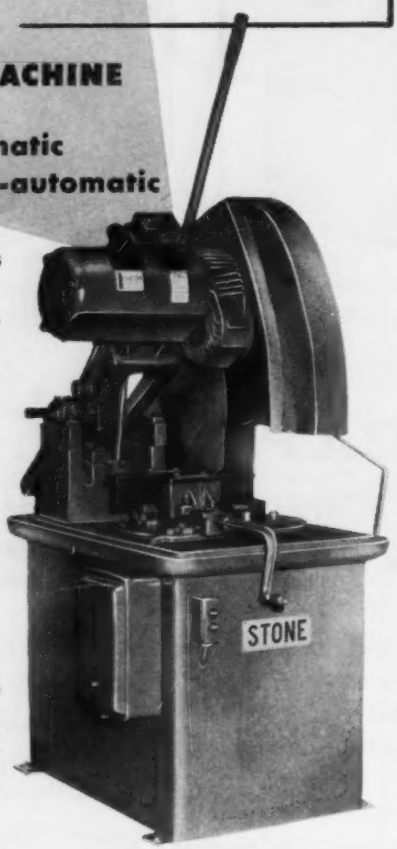
See for yourself! Ask your SKF man to show you his desk top demonstration of the new "C" type bearing. 6127

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

More Delivered Power for FASTER, CHEAPER
Cuts Thru LARGER Solids and Shapes

NEW STONE
M-160
CUT-OFF MACHINE
manual
semi-automatic
fully-automatic

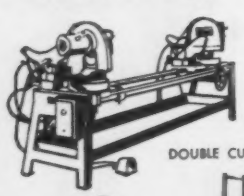


Delivering 15 hp to the spindle, this new heavy-duty, high-speed addition to the Stone "world's most complete line," will slice quickly through a wider range of ferrous, non-ferrous and non-metallic solids and shapes. These 20" and 24" saws . . . driven at constant speed by an induction-type, geared-in-head motor . . . cut to mill-like finishes and tolerances. No hardening of stock. No change in characteristics.

Has stationary wheel guard for maximum safety. May be equipped for wet or dry, manual, semi-, or fully automatic cutting. With automatic barfeed, the M-160 actuated by electro-air oil-check makes up to 1600 cuts per hour.

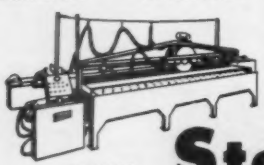
ALL THESE STONE FEATURES

Geared-in-head, T.E.F.C., ball bearing 208/220/60/3 or 440/60/3 motor with load ammeter, overheating indicators, and No. 2 magnetic starter. Fast acting, self-centering vise, adjustable to 46° cutting, clamps close to cut regardless of angle. Heavy, cast machined table ideal for jigs and fixtures. Oil mist spray for non-ferrous cutting.


DOUBLE CUT

DOUBLE MITER

AUTOMATIC CHOP STROKE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Specialists in cut-off machinery, Stone Machinery equipment is used by every major industry throughout the civilized globe. Write today for complete information on the new M-160 or literature describing latest developments and improvements in other types.

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HIGH SPEED CUTTING MACHINERY

FIELD REPORT

200 tons per day, with liquid nitrogen becoming the primary product. Completion of the new facility is scheduled for March.

Pall Corp Acquires Canadian Firm

Vector Laboratories Inc of Montreal has been acquired by Pall Corp, Glen Cove, NY. Vector specializes in solving problems of electro-mechanical and electronic control. Equipment developed by the company includes SCAD (Servo Calibrating Automatic Densitometer); tape controlled program timers; temperature scanners for monitoring large numbers of points with a single indicator-alarm; and temperature controllers for averaging temperatures over large area platens.

Farrington Sanford . . .

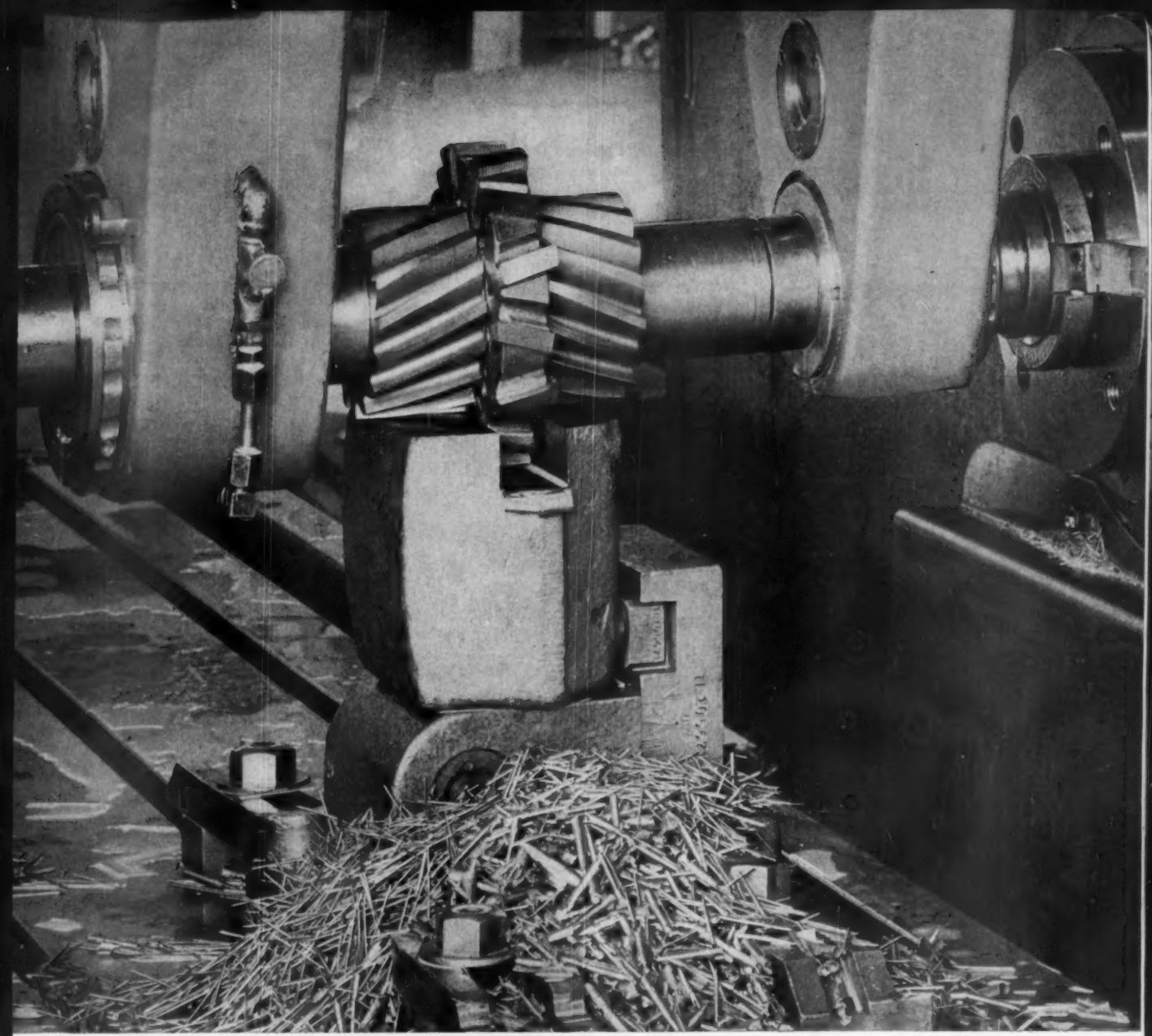
. . . a division of Farrington Manufacturing Co, Needham Heights, Mass, has been established to handle the research and licensing activities of the recently acquired Sanford Process Co of Los Angeles. The Sanford Process is a method of hard-coating aluminum alloys used for industrial, architectural, and other purposes. Business and assets of the Sanford firm were acquired in August by Electralab Printed Electronics Co, a Farrington subsidiary engaged in production of printed circuits for the electronic industries.

AM/MM

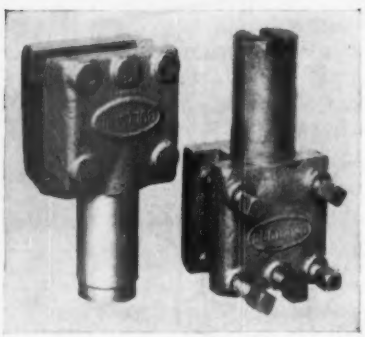
"He helped get me this job—haven't spoken to him since!"

CIRCLE 423 READER SERVICE CARD

CIRCLE 424 READER SERVICE CARD ►



For over 20 years



Bullard machine tool posts of 1045 SAE steel, forged, normalized, and annealed are slotted and faced on top and two sides in the excellent time of 10 minutes per cut.

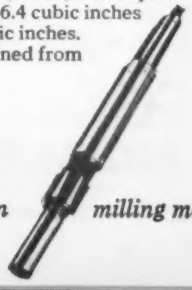
BULLARD machine tool posts
have been slot-and-slab milled with OK milling cutters

Bullard tool posts are standardized for both their vertical turret lathes and boring mills. Batches of 25 and 50 are constantly in the process of manufacture for replacements and new machine sales.

Each tool post is a 41 lb forging of SAE 1045 steel, normalized and annealed. Heads are slotted and faced on three sides in a single pass on a 50 HP Cincinnati Hypowermatic milling machine with a 6" OK inserted blade high speed steel alternate angle milling cutter flanked by two OK solid high speed steel helical mills. Depth of slot, 1-3/8"; Depth of slab cut, 1/4". Speed, 42 rpm; Feed, 2-3/4" pm. Total width of cut, 4-11/16". The inserted blade cutter removes 26.4 cubic inches of metal per pass while the flanking solid cutters remove 18.6 cubic inches.

OK Tool Engineers can help you with production data gained from hundreds of case histories. Put your problem up to them.

THE OK TOOL COMPANY, INC., *Milford, New Hampshire*

OK *modern milling* *cutters for* *modern*  *milling machines*

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Noblewest bench models represent outstanding value in machines for **permanently** indented metal marking Available in many sizes and types from light duty to all-pneumatic models that have the features of larger, more costly floor models.

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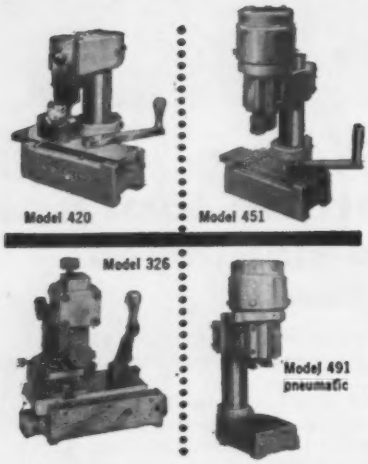

Noblewest makes finest quality dies at competitive prices for all marking purposes.

* mark it best with
NOBLEWEST

FIELD REPORT

Fawick to Produce Dunlop Line

Fawick Airflex Division, Fawick Corp, Cleveland, has completed a licensing agreement with Dunlop Rubber Co Ltd of England under which Fawick will manufacture and sell caliper disk clutches and brakes for industrial applications in the US. These units have been proved in severe braking applications on industrial and automotive equipment.

Designated as Fawick/Dunlop caliper disk clutches and brakes, they are designed to meet requirements for powerful clutching or braking in modern machinery and are applicable in such areas as materials handling, metalwork, motor brakes, and tensioning.

Missile Equipment Firm Acquired by Stylon

As part of a long-range diversification program, Stylon Corp, manufacturer of ceramic wall and floor tile, headquartered in Milford, Mass, is acquiring Hanson Bros Inc, Whittier, California-based designer and manufacturer of missile and space equipment. The company will operate as a wholly owned subsidiary of Stylon. The Hanson facility becomes the sixth plant in the Stylon complex which includes, in addition to its Milford headquarters, the Redondo Division outside of Los Angeles, two plants in Florence, Ala, and one in Salt Lake City.

Reynolds to Supply Aluminum For Special Purpose Freight Cars

A $2 million order for aluminum to be used in the fabrication of the largest special purpose freight cars ever made has been awarded to Reynolds Metals Co, Richmond, Va, by Magor Car Corp, Clifton, NJ.

The aluminum sheet and plate, second largest order of its kind ever placed, will be used by Magor to construct 200 giant covered hopper cars ordered by Southern Railway System. The cars, each containing four hopper bins, will have 5000 cu ft of capacity.

Taco Heaters Buys DuCas

DuCas Corp, Providence, RI, manufacturer of fluid transfer glands for gun drilling applications, has been acquired by Taco Heaters Inc, Cranston, RI. DuCas products are designed to transfer fluids from a stationary high-pressure line to a high-speed rotating line. They are capable of operating at high speeds and pressures with the elimination of fluid turbulence. Variety of models and sizes are available to handle a range of machine and process requirements.

Holden Moves Detroit Facilities

Detroit facilities of A F Holden Co, manufacturer of heat treating furnaces, salt baths, and process equipment, are being transferred to the company's newly erected headquarters plant at Milford, Mich. The Milford plant has been expanded to house offices for engineering, sales and administration personnel, a research lab, and new manufacturing facilities. Move does not affect the company's New Haven, Conn, plant operation.

Eaton Renames Division

Eaton Manufacturing Co, Cleveland, has changed the name of its Pump Division to the Marshall Division. The facility is located in Marshall, Mich, and is a leading producer of hydraulic pumps for the automotive industry. The division has been actively working on product diversification since 1958. It'll continue to make a wide range of hydraulic pumps, however.

Electric Storage Battery Co . . .

. . . Philadelphia, has been awarded a $7.5 million contract by the Navy for submarine batteries. This is the largest peacetime order for such batteries ever placed by the Navy with a single supplier. Deliveries are scheduled to begin in January 1962 and are to be completed within 14 months. •

AM/MM

"Before you make some ridiculous offer on a trade-in, I think you ought to know the Smithsonian Institute has offered $4850 for it!"

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You pay only for the strength and machinability you really need. In Strain-Tempered steels the selection is wide, from the industry's most complete line of high strength cold finished steel bars. This includes both carbon and alloy analyses, leaded or unleaded.

Let us show you how Bliss & Laughlin can cut your costs and get rid of your heat treating headaches.

Bliss & Laughlin has been producing cold finished steel bars for 70 years, Strain-Tempered bars for 30 years. Call on this experience!

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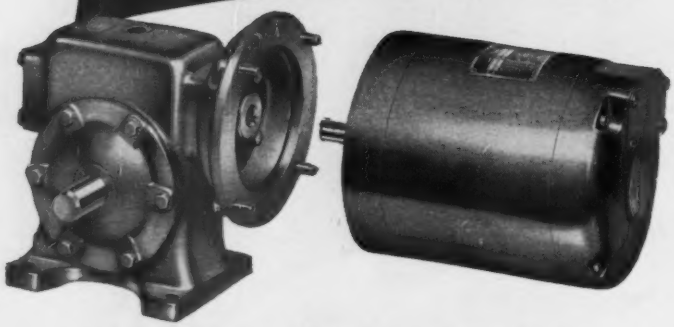
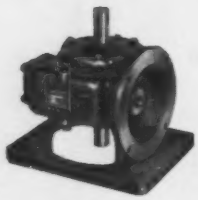
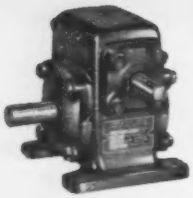
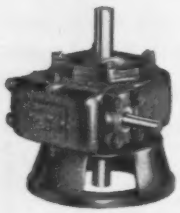


PERFECTION
Worm Gear
SPEED REDUCERS







One of our major capabilities is to design, develop and produce speed reducers that will insure maximum performance and economy in your operation. Our experience in the special problems and objectives of power transmission is broad and deep. The men at American Stock Gear having this important capability, use the most advanced analytical engineering facilities to design speed reducers to meet tomorrows needs.

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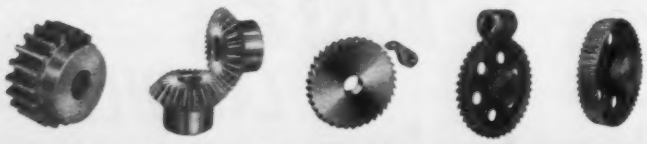

AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY, HARVEY, ILLINOIS

NAMES IN THE NEWS

Borg-Warner Corp, Chicago, has announced that **Roy C Ingersoll** (top) has resigned as chairman of the board. **Robert S Ingersoll** (center), president since 1956, has been elected board chairman and chief executive officer. **Lester G Porter,** executive vice president, has been named president of the firm

Fusion Engineering, Cleveland, has named **Thomas Allchin** head of a newly created Machinery Division which will specialize in fixturing of parts and automatic movement of assemblies during automatic soldering processes. Mr Allchin has been associated with Osborn Manufacturing Co and F J Stokes Machine Co in the design, sales, and service of special purpose machinery.

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LOW COST • MINIMUM MAINTENANCE • LONG LIFE • NO ELECTRON TUBES • REQUIRES NO WARM-UP • STARTS MOTOR INSTANTLY • DELIVERS HIGH INITIAL TORQUE • ACCELERATION IS SMOOTH WITH CONSTANT TORQUE • CAN BE USED FOR OVER-VOLTAGE STARTING OF MACHINERY TO OBTAIN MAXIMUM SPEED IN MINIMUM TIME • LETS MOTOR DELIVER RATED TORQUE OVER ENTIRE SPEED RANGE FROM RATED TO STALLING • SMOOTH, CONTINUOUS SPEED ADJUSTMENT • GOOD REGULATION • EXCELLENT FORM FACTOR FREE OF CHATTER-CAUSING TORQUE PULSATION • INSTANT ONE-SWITCH REVERSING • STARTS AND STOPS HEAVY LOADS QUICKLY • DYNAMIC BRAKING • OVERLOAD PROTECTED • EASY TO INSTALL • COMPACT SIZE • AVAILABLE IN STRIPPED-DOWN MODELS FOR USE IN ORIGINAL EQUIPMENT

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For control of D-C Motors up to ¾ HP from A-C Lines

	SPEED RANGE	COMPLETE MODEL	STRIPPED-DOWN MODEL
For shunt motors 1/15 hp or less	0 to rated 0 to 2x rated	1701-AK $95	1701-AKW $72
For shunt motors 1/15 hp or less	0 to rated	1701-AM $95	–
For series or universal motors 1/15 hp or less	0 to rated	1701-AU $95	–
For shunt or compound motors 1/12 hp to 1/6 hp	0 to rated 0 to 1.25x rated 0 to 1.5x rated	1703-A $110	1703-BW $90
For shunt or compound motors 1/4 hp to 1/3 hp	0 to rated 0 to 1.15x rated	1700-B $180	1700-CW $155
For shunt or compound motors 1/2 and 3/4 hp	0 to rated 0 to 1.15x rated	1702-A $255	1702-BW $215

Quantity Discounts Apply — Motors Available

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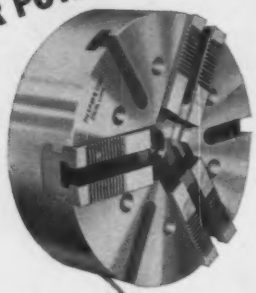
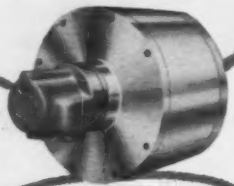
SUPER POWER CHUCKS

and
ROTATING
Air or Hydraulic
CYLINDERS

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HEAVIER FEEDS
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A-4453A
The S-P Manufacturing Corp.
A BASSETT COMPANY
ESTABLISHED 1916
30201 Aurora Road • Cleveland 39, Ohio

Standard Pressed Steel Co, Jenkintown, Pa, has named **Burton W Van Dyke** manager of manufacturing. He has been serving as manufacturing manager of fastener products since early this year

Curtiss-Wright Corp, Wood-Ridge, NJ, has elected **I Nevin Palley** executive vice president. Mr Palley was formerly president of ITT-Federal Laboratories, Nutley, NJ

Metal & Thermit Corp, Rahway, NJ, has named **Charles J Beasley** president to replace **H E Martin** who has become board chairman and chief executive officer. Mr Beasley was formerly vice president and secretary. **H W Buchanan,** previously a vice president, has been named executive vice president

Hoefer Manufacturing Co, Freeport, Ill, maker of special machinery, drill heads, and electro-mechanical devices, has named **Henry J Miller** president and chief executive officer. He was formerly operations manager of the Micronics Division of Elgin Watch Co.

Strategic Industries Association, headquartered in Los Angeles, has elected **Robert R Lent,** business consultant of Bel Air, Calif, as president for the 1961-62 term. **John Marschalk,** assistant to the president of **Anadite Inc,** has been elected first vice president of SIA, and **William P Patterson,** vice president and general manager of **United ElectroDynamics,** has been named second vice president.

Johnson Bronze Co, New Castle, Pa, has appointed **Myron K Boatman** chief manufacturing engineer responsible for industrial production engineering. He has been serving as divisional engineer, Aluminum Division.

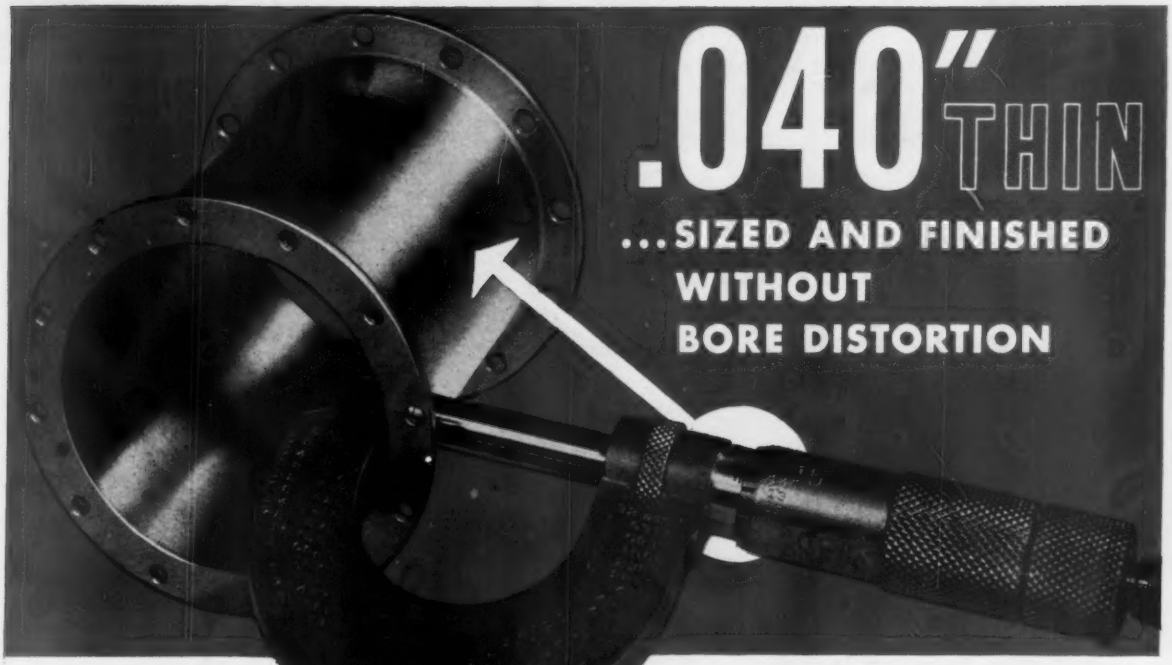
Ryan Aeronautical Co, San Diego, has elected **Robert C Jackson** president, effective Nov 1. **T Claude Ryan** continues as board chairman and chief executive officer. Mr Jackson has been executive vice president for the past two years.

Borg-Warner Ltd, English subsidiary of **Borg-Warner Corp** of Chicago, has appointed **John R Mueller** managing director of the Morse Chain Division. Mr Mueller became associated with the subsidiary last year as general manager in charge of chain and sprocket production.

Crane Co, Chicago, has elected **Dante C Fabiani** president. He was formerly executive vice president.

Buhr Machine Tool Co, Ann Arbor, Mich, has appointed **Walter R Naas** director of foreign sales. Mr Naas, who has been associated with Buhr for the last two years, will establish offices in Switzerland.

Norgren Co, Englewood, Colo, manufacturer of pneumatic products, has appointed **Jim Machen** to the post of materials manager. He was previously Englewood plant superintendent. **Paul Williams,** superintendent of the Littleton plant, has taken over the responsibilities of all manufacturing operations.



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- For Machine Applications Standard from stock, .100" through 2.625" dia. Built to order, through 4½" dia.
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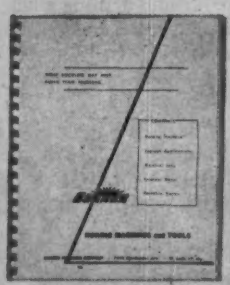

FREE BULLETIN #SP-11

Gives production rates on 99 typical honing applications. Contains valuable information on Sunnen Honing Machines — Mandrel Sets — Portable Hones — External Hones — New Precision Hole Gage

In many cases, it's impossible to produce true-round bores in thin-walled parts by any process that requires chucking. Reason: They "spring back" when chucking pressure is relieved. Cutting tool pressure and heat generated during stock removal will also distort many thin-walled parts.

SUNNEN HONING solves all these problems! With this efficient stock removal process . . . no chucking is required because the work piece "floats" on the honing tool. *Chucking distortion is eliminated!* Stock removal is fast . . . with relatively low pressure and surface speed. *Distortion from cutting pressure and heat is eliminated!* Results: A geometrically true-round, straight bore.

Production tolerances held on the 1¾" bore stainless steel cylinder shown above are ±.0002". . . with 8 micro-inch finish and .003" average stock removal.

Your own machining problems may not be quite this difficult, but Sunnen Honing will save you money if you do internal work of any type. It guarantees accuracy to .0001" with any desired finish down to 2 micro-inches

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Now, after more than four years' research, Kalamazoo brings to you the all new Model 14A — horizontal metal cutting bandsaw. Incorporating some 30 shop proven, cost saving features, this hydraulic driven, heavy duty bandsaw offers cutting capacity and ability in excess of any cut-off method, at far less tool cost per square inch of cutting.

Most important among these profit producing features are: positive control force feed; clockwise blade rotation to reduce teeth shock — increase blade life; convenient 36" machine height to reduce operator fatigue; large 14" x 24" capacity; push button control; dual movable vise jaws; adjustable blade tension.

For complete details on this amazing new machine tool, phone, write or wire your Kalamazoo representative. Facilities for test runs of your material on the "Big K" are at your disposal — at no obligation.

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Company

508 Harrison St.
Kalamazoo, Mich.

NAMES IN THE NEWS

Detrex Chemical Industries Inc, Detroit, has elected **Leroy Camel** vice president. He will continue as sales manager of the Chemical Processing Division.

Metal & Thermit Corp, New York has appointed **Chester G Borlet** plating products specialist for the Plating Division, located in Detroit. He was formerly technical director of Grand Rapids Brass Co, Grand Rapids, Mich.

Dana Corp, Toledo, has appointed **C C Dybvig** to the newly created post of vice president, marketing. He has been serving as vice president, sales.

K R Beardslee, who retired last spring from General Electric management after serving as president of Carboloy Co, and later general manager of the Metallurgical Products Department, is now associated with **Oscar M Guensche,** owner of **Dawson Carbide Industries** of Detroit, and its affiliate, **Harrisville Tool Co** of Harrisville, Mich.

Western Gear Corp has promoted **Raymond W Whelan** to the post of chief engineer of the Industrial Products Division, Belmont, Calif. He has been sales manager for engineered products at Belmont and now succeeds **Leo Martin** who has retired.

OBITUARIES

Otto R Reller, 72, vice president in charge of production, and a director of **Moline Tool Co,** manufacturer of cylinder boring and drilling machines in Moline, Ill, died Aug 22. He joined the company in 1914 and was made a vice president in 1945.

Sigmund Waldes, 83, president and board chairman of **Waldes Kohinoor Inc,** Long Island City, NY, manufacturer of Truarc retaining rings and assembly tools, died Sept 18.

Dr Oswald Kolbert, 62, technical director of **Waldes Kohinoor Inc,** died Sept 20. Dr Kolbert joined the firm in 1941 and had been in charge of all engineering since 1946.

H Stanley Rogers, board chairman of **American Shear Knife Co,** Homestead, Pa, died Sept 8. Mr Rogers was a co-founder of the company which manufactures metal cutting and wood pulp knives. •

Switch Control:

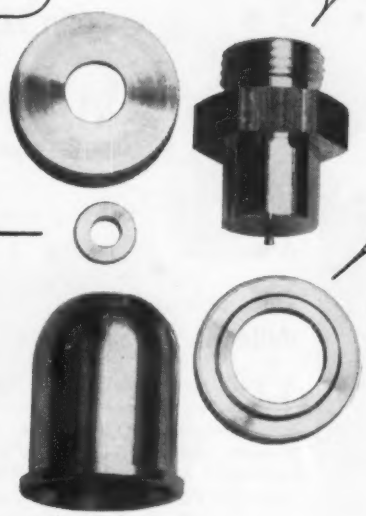
Another Olin alloy change saved the manufacturer about 7% on metal and resulted in higher machine operating speed.

Aircraft Fitting:

Superior surface finish of Olin hexagonal bar eliminated need for secondary finishing operation.

Clock Time Wheel Hub:

An Olin-recommended alloy change resulted in a raw material cost saving of 11%.



Fuel Valve Body:

Olin rod and Olin technical help reduced machining time from 5.5 to 2.4 seconds.

Electronic Part:

The high quality of Olin Aluminum improved the surface finish 25%. Reduced machine down time.

We speak your language: savings!

These endorsements from various manufacturers are typical of the results achieved through Olin's technical assistance—and the use of Olin Aluminum Rod and Bar. Olin *cold processed* Aluminum Rod and Bar is ideal for screw machine products because of its uniform structure and fine surface finish. Olin's Distributor network, coast to coast, carries a full range of this stock in a variety of sizes and alloys. These same Distributors, or your nearest Olin Aluminum Sales Office, will arrange for Olin's technical and marketing service if you'd like some help. Look in The Yellow Pages.

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Milling ALUMINUM

up to ten times faster

than by any other means!

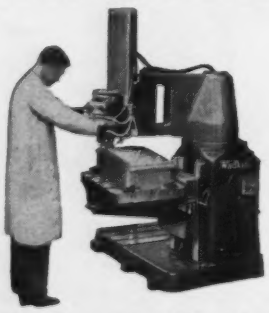
Wadkin heavy duty Articulated Arm Router, LC. face-milling the weighing machine component, shown above.

The medium capacity Articulated Arm Router type L.C.6 with power rise and fall to the head, integral base plate, and rising and falling tilting table.

This component is face-milled in 130 seconds!

HERE is a typical example of the amazing time and cost-cutting advantages of machining aluminium components on a Wadkin Articulated Arm Router. This Router face-mills the weighing machine component, shown above, in a fraction of the time taken by any other method. Moreover, the initial cost of the Wadkin machine is relatively low as compared with conventional millers. Wadkin Routers employ new, high-speed milling techniques. With cutting speeds up to 18,000 r.p.m., low tooth loading of the cutter, and only light clamping of the component face-milling is done in a fraction of the time normally taken. On pocketing operations, too, an easily obtained metal removal rate of 20 cubic inches per minute cuts production times to an absolute minimum.

Write today for Catalog 945 from your nearest Wadkin Agent, listed below.



Wadkin

HIGH SPEED MACHINE TOOLS

Supreme Machine Tool Corp., 130-140 180th Street, Springfield Gardens, Jamaica 34, N.Y.
Machinery Sales Co., 2838 Leonis Blvd., P.O. Box 58362, Los Angeles (Vernon) 58, CAL.
Wigglesworth Machinery Co., 60 Border Street, P.O. Box 166, East Boston 28, MASS.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

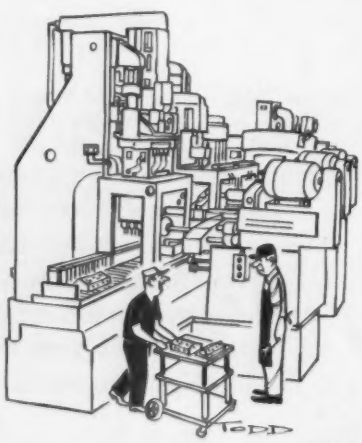
1 AUTOMATIC DRILLING MACHINES—*Burgmaster Corp, 15001 S Figueroa St, Gardena, Calif.* 16-page catalog illustrates and describes Burgmaster 6 and 8-spindle automatic hydraulic turret drilling machines. Covers optional features and attachments including automatic tape controls that adapt the machines to wide ranges of work. Shows special machines built from standard components for specific work and contains case histories of installations.

2 ASSEMBLING AND PROCESSING MACHINES — *Swanson-Erie Corp, 814 E Eighth St, Erie, Pa.* 20-page bulletin on multi-station automatic units pictures completed automation machines, both standard and special models, and indexing machine chassis made in stock models ready to apply to special automatic machines requiring intermittent work transfer motion.

3 AIR POWER PRESSES — *Hannifin Co, Dept 518, 501 S Wolf Rd, Des Plaines, Ill.* 8-page consolidated bulletin 0960-B1 gives complete dimensioning and technical information for all open gap and column units in both bench and floor mounting models. Thirty-four press sizes are offered in a broad choice of capacities from ½ to 50-ton force at 80-psi airline pressure. These presses are particularly suited for assembly, riveting, forming, bending, and molding applications.

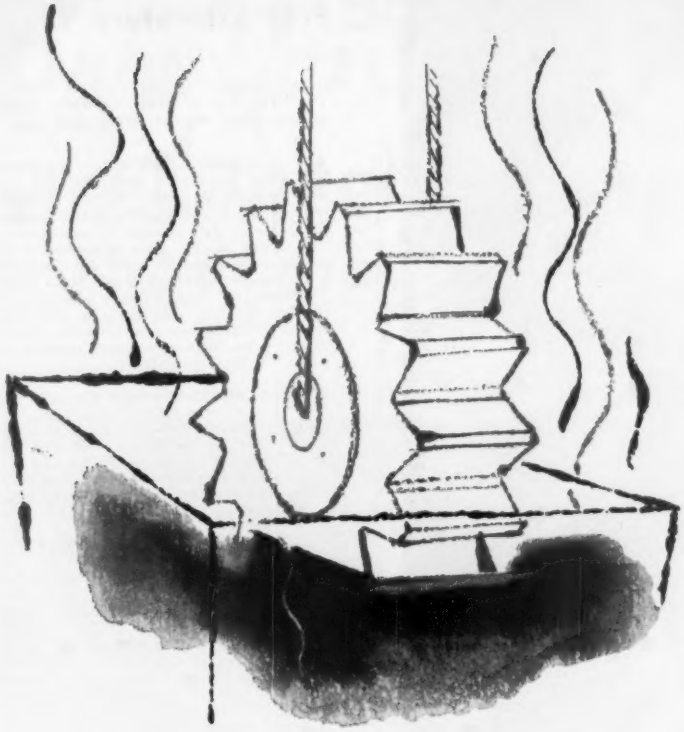
4 MULTIPLE TRANSFER PRESSES *Baird Machine Co, 1700 Stratford Ave, Stratford, Conn.* Pocket-size folder covers four representative models of the Baird multiple transfer press line. Data on rated capacity (in tons), production speed capability, and a listing of typical applications is offered on each machine.

5 MILLING MACHINE — *Brown & Sharpe Mfg Co, Machine Tool Division, Providence 1, RI.* 20-page bulletin MM 58 contains specifications and illustrations covering the construction, operations, and optional equipment for the new B&S Rangemaster sliding-head milling machines. They are available as either plain or universal units and have 3-hp spindle drive motors.



AM/MM

"Nice work you've been turning out Steve, which button do you press?"



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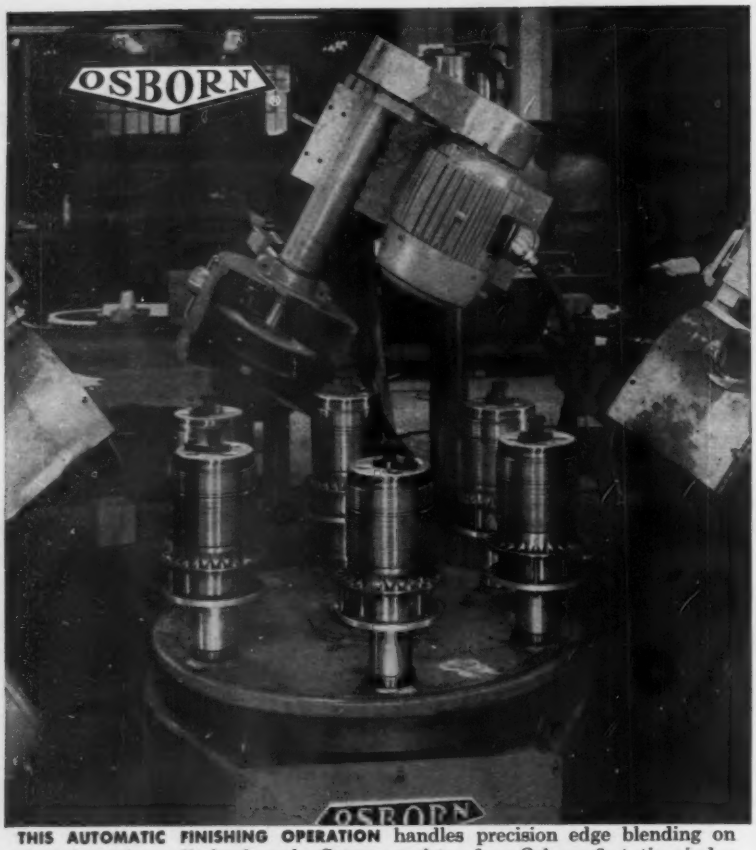

THIS AUTOMATIC FINISHING OPERATION handles precision edge blending on aircraft engine cylinder barrels. Setup consists of an Osborn 6-station index table and three finishing heads equipped with Osborn Fascut® Brushes with deburring compound. Heads No. 1 and 3 each brush one minute clockwise and ccw to put .020" blend on edges of mounting holes. Head No. 2 brushes 1½ minutes cw and ccw to put .010" blend on top edge and O.D. thread ends.

EDGE BLENDING cylinders

done 566% faster with OSBORN power brushing

Here's an aircraft manufacturer with a problem: specifications for these reciprocating engine cylinder barrels called for precision tolerances. Hand finishing rate: 3 parts an hour . . . too slow . . . too costly.

Today, an automatic Osborn Metal Finishing Machine handles the work . . . *power brushing* the parts rapidly, uniformly, economically. Rate: 20 an hour . . . *566% faster with exceptional quality control.*

It's another case-in-point of today's Osborn power brushes and brushing methods at work throughout industry solving tough metal finishing problems. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no obligation—can cut costs on *your* deburring, cleaning, polishing and precision blending operations. Write or call *The Osborn Manufacturing Company, Dept. C-117 Cleveland 14, Ohio. Phone ENdicott 1-900.*

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Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

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6 BURNISHING MACHINE—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Data Sheet 1026-61 provides information on new machine that strengthens parts at critical fillets by coldworking and compacting the surface. Machine cycle is completely automatic except for hand load and unload. Describes operation of the Roto-Flo Model 1026 Radii Finisher in detail and is complete with specifications including typical production rate and capacity. Photos illustrate overall machine and close-up of workpiece being finished.

7 KEYSEATERS—*Davis Keyseater Co, 3111 Winton Rd S, Rochester 23, NY.* 4-page illustrated bulletin gives description of the machine specifically designed to cut single or multiple, straight or tapered, internal keyways. Additional card lists data to help in selection of proper size of keyway for variety of jobs.

TOOLS AND ACCESSORIES

8 INSTRUMENTATION—*C L Berger & Sons Inc, 37 Williams St, Instrumentation and Apparatus Division, Boston 19, Mass.* 22-page booklet illustrates products and production capabilities for manufacture of such components as precisely-graduated dials and verniers with arcs and segments accurate to one second of arc; tapered spindles accurate to 0.00005 in. for rotating mechanisms; precision level-vial assemblies with sensitivities ranging from one second of arc per two mm division to 30 minutes; alignment and other optical-mechanical instrumentation devices.

9 BROACHES—*The duMont Corp, 289 Wells St, Greenfield, Mass.* 20-page catalog illustrates and provides quick-reference information on complete line of Minute Man broaches. Sizes and specifications are tabulated for keyway broaches and kits, square, round, and hexagonal broaches. Operating and ordering information included together with useful reference data on keys, keyseats, and broaches for special applications.

10 "ADVANCED TRENDS IN ELECTRIC GAGING"—*Hamilton Watch Co, Industrial Products Division, Lancaster, Pa.* 8-page brochure GB-2 illustrates and explains the function of the Hamilton electric indicator and control units and describes typical applications of electric gaging to reduce cost of parts fabrication and inspection.

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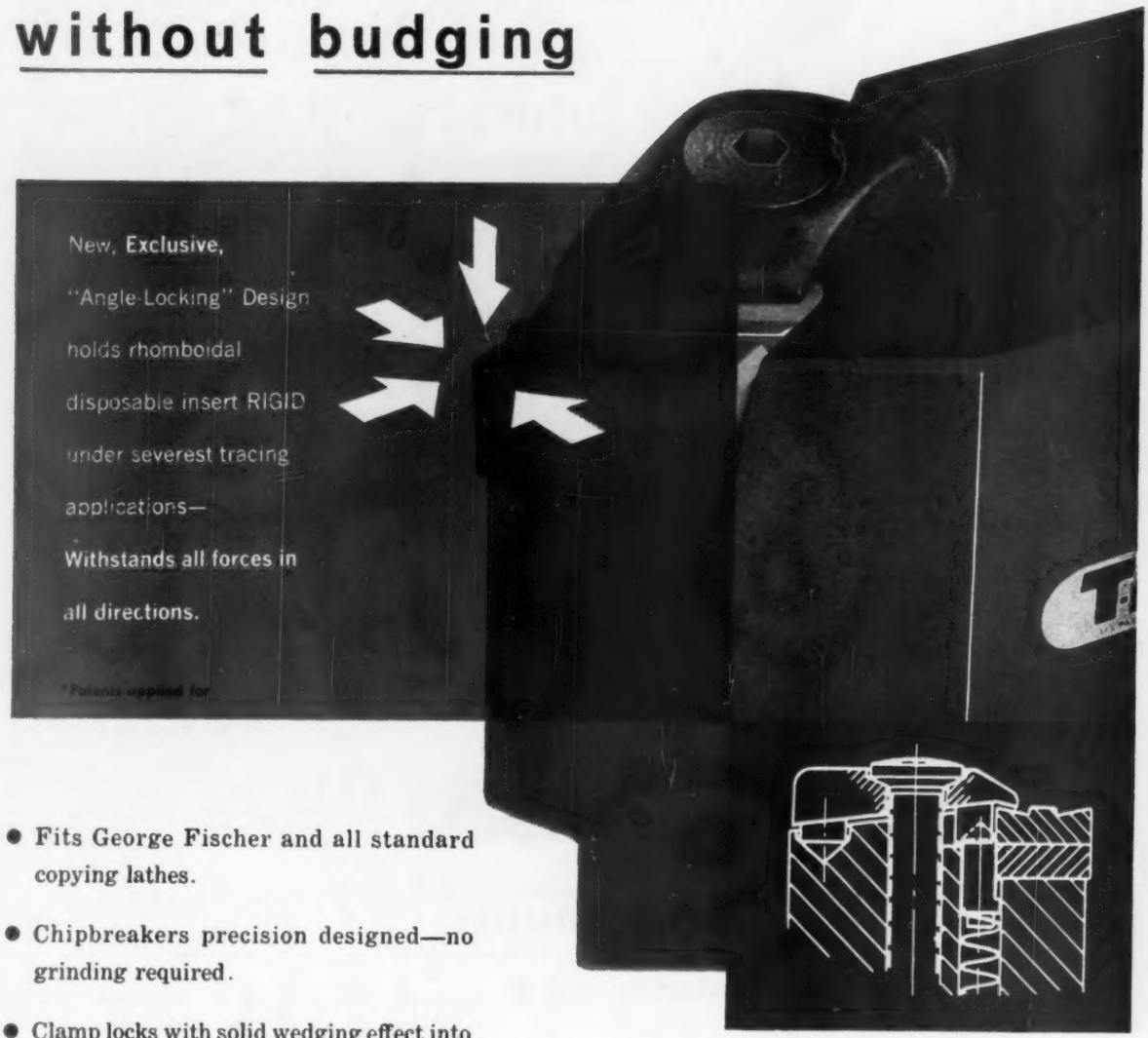
"Harold hasn't been himself lately—have you noticed the improvement?"

SANDVIK Only Coromant T-MAX

takes toughest Copying Forces without budging



- Fits George Fischer and all standard copying lathes.
- Chipbreakers precision designed—no grinding required.
- Clamp locks with solid wedging effect into the "V" formed by the inclined surface of insert and back of chipbreaker.
- Spring pin, clamp-lifter presses against inclined surface on clamp, swinging it against stop to eliminate all play.
- Simplest changing—a minimum of parts to handle.

Send for further details on this and the entire Coromant line of carbide tooling.

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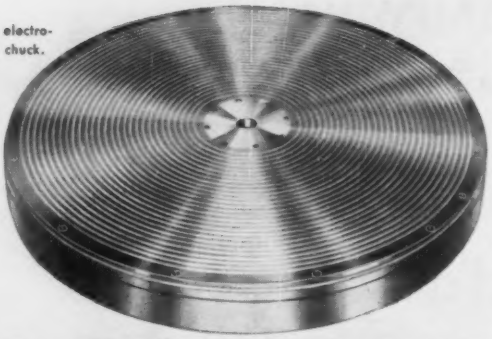
FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY

72" Magna-Lock electro-magnetic rotary chuck.

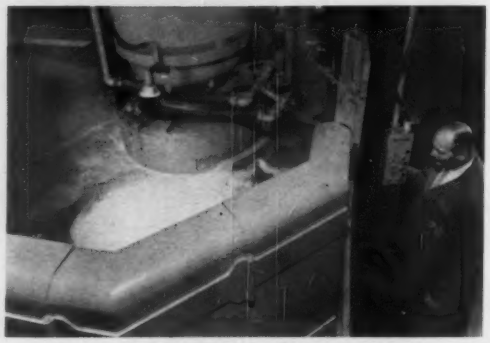


BIG

Magna-Lock ROTARY CHUCKS

BIG

MATTISON ROTARY GRINDERS



Magna-Lock 72" rotary chuck on a Mattison No. 60 Grinder

. . . HIGH production efficiency

Magna-Lock CHUCKS ARE ORIGINAL EQUIPMENT ON MATTISON GRINDERS

For fast, heavy stock removal, hold your work with the tremendous power of Magna-Lock Rotary Chucks. Electromagnetic type 6¼" to 120" diameter. Permanent magnet type 4¾" to 12" diameter. Many special applications. Automatic loading and unloading. For top production, get Magna-Lock.

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This report shows how interferometers can measure and compare lengths, angles, parallelism, and surface condition.

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11 LUBRICATING AND ELECTRICAL DEVICES—*Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis.* 12-page catalog 61 covers complete line. Contains photos, catalog numbers and such engineering data as specifications and operation descriptions of automatic oilers, chain oilers, dispensers, single and multiple valves, mist systems, industrial fuses and fuse accessories.

12 NUMERICAL POSITIONING CONTROLS—*Rheem Manufacturing Co, Electronics Division, 5200 W 104th St, Los Angeles, Calif.* 12-page brochure includes a control block diagram and step-by-step explanation of the use of automatic numerical positioning controls for machine tools. Additional publication on a turret drill application of Rheem numerical positioning controls reports in detail on a case study comparing time and cost for conventional manual machine drilling with numerically controlled drilling for a specific part. For 40 parts, total cost of each part as conventionally made was $14.02 as against $2.67 for automatically controlled production.

13 LUBRICATING GREASE — *Bardahl Manufacturing Corp, 1400 N W 52nd St, Seattle 7, Wash.* 32-page booklet covers in a concise summary the basic principles, properties, types and rules for choice and application of lubricating grease including the effect of additives on the properties of grease.

14 TOOLS AND ACCESSORIES—*Reid Tool Supply Co, 332 W Delano Ave, Muskegon Heights, Mich.* 87-page catalog pictures, gives brief description, and dimensions of balls, broaches, blow guns, clamps, die components, engineering aids (tables, gage dials, calculators), eye bolts, fixture locks, handles and knobs, hand wheels, setup aids, springs, slotted sleeves, tool components, tool and die maker's aids, vises.

● CARBIDE TOOL NEWS — *Wesson Corp, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* Publication, now put out as an external house organ edited especially for tool engineering, production and purchasing executives is now available. First issue of the quarterly is Vol 7, No. 1. Carbide Tool News will present illustrated news stories in capsule form on latest tool de-

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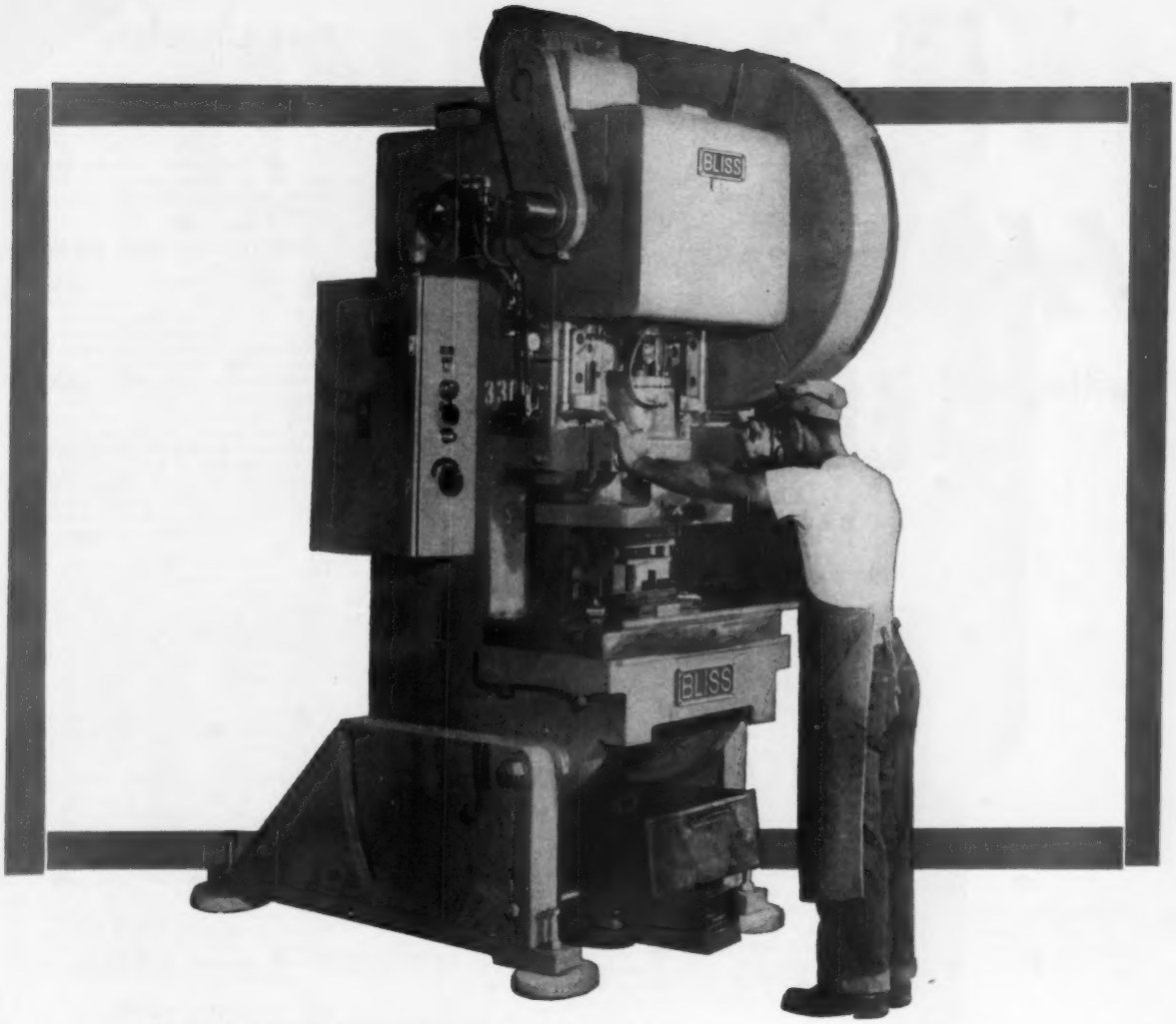

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HOLES!

ELDORADO GUN DRILLS are **job and application proved** for all types of complicated and run-of-the-mill drilling jobs... whether the drill or the work turns. They drill holes faster...to a micro finish... **in one single operation,** assuring a more economical answer to more hole problems, than any other drilling method. If you gun drill...your best bet is an ELDORADO! We have a wide range of sizes in STOCK to fit your need...

There's ONE to LOWER YOUR HOLE COSTS!

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Dias. in every 1/64" increment

Size-Dia.	LENGTH	Driver
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.5156" to .7500"	16", 22", 36"	1" x 2¾"
.7656" to 1.0000"	22", 36"	1¼" x 2¾"

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velopments, production methods, and tool materials for milling, turning, and boring operations. Request direct on company letterhead.

HEAT TREATING AND WELDING

15 HARD SURFACING — *Kennametal Inc, Latrobe, Pa.* 8-page illustrated bulletin B-175-A describes how to apply tungsten carbide hard facing. Four forms of Kennametal hard surfacing materials are covered: Tube Kenface, applied by three methods; Kenface bulk powder, suitable for many methods of application; Kenspray powder, applied by metal spray gun and then fused at 1875 to 1950 F; and a new Kenface Arc Rod KT-200, developed to improve application of hard surfaces by ac or dc electric arc. Gives detailed procedure for application. Performance records of machine parts hard surfaced by each method are included. Typical applications listed.

16 ELECTRON BEAM FURNACE — *Temescal Metallurgical Corp, 2850 Seventh St, Berkeley, Calif.* 8-page brochure describes a giant 1,000,000 lb/yr unit, largest ever built, and other new Temescal developments based on high vacuum technology. Covers electron beam melting techniques; describes continuous strip annealing using an electron beam; newly devised high-rate evaporation sources, and other projects in advanced stages of development or recently completed by Temescal.

17 SPIN/HARD HEAT TREATMENT — *Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 4-page folder 2922 discusses this heat treatment of sprockets, gears, traction wheels, rollers, and other products requiring hardened areas for high wear resistance. The treatment produces a minimum hardness of Rh C 55, ⅝ in. to ½ in. deep, on iron and steel castings and fabricated components from 8 to 42-in.-dia. Process hardens wearing areas only and allows remainder of component to retain its machinability.

18 HELIWELD EQUIPMENT — *Air Reduction Co, 150 E 42nd St, New York 17, NY.* 24-page catalog 2300 describes Airco equipment, manual, semi-automatic, and automatic. Practically any metal or combination of metals can be handled.

(Continued on p251)

AM/MM

"We made a startling discovery while you were on your vacation."

UNLOCK GRINDING POTENTIAL

...take the BESLY 3G ROUTE

What is the Besly 3G Route? Simply the most direct path to achieving fullest grinding potential. It's a plan of analysis that will help you get the greatest economy, the finest quality and the highest level of production from your grinding operations. Here's the way it works:

G1 The *abrasives* you use are examined and studied under the conditions in which they are used to discover if they are right for the job and if they are reaching potential.

G2 Your Besly grinding *specialist*—your G²—prepares your routing to potential. Abrasives, coolants, methods, materials and machines . . . all are explored for potential, for improvement.

G3 The grinding *machines* that you use and those available are evaluated in the light of your grinding needs. The machine that will produce to your potential is recommended.

NEW BOOKLET! Tells how you can increase grinding potential. Write for your copy today!

BESLY®

BESLY-WELLES CORPORATION

120 Dearborn Avenue • South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press® Taps
Drills • Reamers • End Mills • Tool Bits • Gages
Carbide Tipped Tools • Blanks • Inserts • Holders

ASK YOUR BESLY G² FOR AN ABRASIVES PERFORMANCE TEST—1—Tell him the material to be ground. 2—Tell him the amount of stock to be removed. 3—Tell him the finish required. 4—Tell him the area in contact with the abrasive. 5—Tell him the spindle speed. He'll do the rest!

New

IN-LINE LOADER

SERVES RED RING SHAVING MACHINES ON AUTOMATED LINES

This new Red Ring Loader automatically conducts work gear units straight through the shaving station of an automated machine line in the simplest, most direct way.

4 PRINCIPAL ADVANTAGES

* Accommodates larger diameter work gears
* Eliminates the need to change direction of work flow to and from shaving
* Feeds by gravity from either side
* Suitable for all Red Ring Model GCU Machines

UNRESTRICTED CHOICE

When automatic feed and discharge from the front of the Shaving Machine is more desirable, the conventional Red Ring Rocker type loader is also available.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTICO

Contact our local representative for complete details.

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

PARTS AND MATERIALS

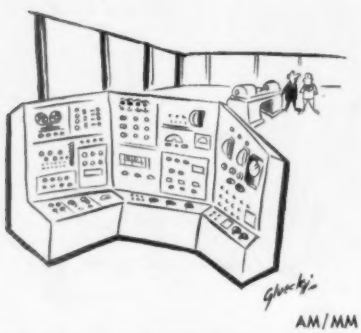
19 LIGHT METALS DATA—*Brooks & Perkins Inc, 1950 W Fort St, Detroit 16, Mich.* 44-page brochure presents design data on characteristics and properties of light metals including magnesium, aluminum, and titanium. Lists comparative values for various metals to assist in selection of materials. Information is presented in tabular and graphic form.

20 "ECONOMICS OF THE V-BAND COUPLING"—*Aeroquip Corp, Marman Division, 11214 Exposition Blvd, Los Angeles, Calif.* 16-page bulletin SDP-2 gives specific cost comparisons between V-Bands and other joining methods. Explains how many hidden costs of manufacturing can be reduced. Savings in weight and installation or assembly time are examples of other types of economies illustrated.

21 MOLYBDENUM — *Schwarzkopf Development Corp, 595 Madison Ave, New York 22, NY.* 57-page brochure, published by Metallwerk Plansee A G of Austria, describes properties of the metal, its availability in mill supply forms and various fabricated shapes, and its present applications in industry. Included in the text is a section on how to machine and work the metal to finished form. There are 45 tables and graphs of properties and specifications plus pictures and sketches of products in actual applications.

22 "MARASET ELECTRICAL RESINS SELECTOR"—*Marblette Corp, 37-31 Thirtieth St, Long Island City 1, NY.* Brochure is a guide to company's insulating resins and their uses for potting, encapsulating, and coating electrical and electronic products, parts, and assemblies. Center chart provides ready reference to rigid and flexible epoxy potting resins, thixotropic dipping pastes, and varnishes. Indicated for each resin in the listing are temperature class and thermal properties; physical and mechanical properties; pot life; type and proportion of hardener; and curing method. Uses illustrated.

23 BEARINGS — *Industrial Tectonics Inc, 18301 Santa Fe Ave, Compton, Calif.* 2-page bulletin, Tech-Tonic No. 11, describes Haynes Alloy 25 deep groove corrosion-resistant bearings with full complement of balls not requiring loading slots or low shoulders. Shows cross-section views of bearings with materials and temperature ranges, production tolerances held, advantages of the design in eliminating common malfunction problems, and general applications.



AM/MM

"Of course when it came to buying the machine tool to go with that control center it turned out this was all we could afford . . ."

THERE'S MORE TO TAPS THAN MEETS THE EYE!

LET'S FACE IT . . .
You will not notice a major difference when you visually compare the same style standard High Speed Steel, ground-from-the-solid taps made by Jarvis with those made by another quality manufacturer.

They will look alike, measure alike . . . they are made of quality steel. With this apparent similarity . . .

. . . THEN WHAT ARE THE IMPORTANT POINTS TO CONSIDER IN SELECTING TAPS?
Selecting the *right tap for the job* is vitally important for top tap performance. Regardless of its quality, the wrong tap cannot do the job properly. And, as you know, poor tap performance can be costly.

3 KEY POINTS TO REMEMBER
The differences in ground thread taps become apparent in their performance. The key to proper tap selection lies in these three critical areas:

1. Selecting the correct tolerance with respect to tapped hole limits.
2. Selecting the correct type of chamfer, chamfer relief, flute contour and pitch diameter relief.
3. Selecting the style of tap as regards number of flutes, or whether it should be spiral pointed or spiral fluted.

HOW TO GET HELP FOR PROPER TAP SELECTION
Jarvis has gone to great lengths to make tap specifying information available. The new Jarvis Tap catalog has a complete section devoted exclusively to engineering information and guidance for tap selection. Also, Jarvis offers its now-famous, handy pocket-size Tap Selector Guide. Both are free for the asking.

In addition, Jarvis sales-engineers are always ready to help solve your tapping problems.

THERE IS A BIG DIFFERENCE IN TAPS AND IN THEIR PERFORMANCE. YOU CAN PROVE THIS TO YOURSELF BY DEPENDING ON JARVIS THE NEXT TIME YOU ORDER TAPS.

WANT ONE OR BOTH?
- **New Jarvis Tap Catalog** (includes 25-page engineering section)
- Jarvis Pocket-Size Tap **Selector Guide**

JARVIS TAP-OF-THE-MONTH

SPIRAL POINTED TAPS

NOTE WIDE RANGE OF SIZES IN STOCK . . . 1/4" to 3/4"

Of particular interest in Jarvis' Spiral Pointed Taps is the exceptionally wide range of Standard sizes (1/4" to 3/4") ready for immediate delivery at regular (standard) prices. You will surely save time and money.

Also available: machine screw sizes #0 — #14 in stock plus wide range of Specials.

5 JARVIS TAP FACTS

1. Years of experience in the manufacture of High Speed Steel ground-from-the-solid taps exclusively.
2. Rigid quality control throughout the manufacturing process.
3. Extensive experience in tapping space age materials.
4. Complete stock of Standards for immediate shipment.
5. Exceptional service on Specials.

Jarvis CORPORATION
- HAND TAPS • NUT TAPS
- MACHINE SCREW TAPS
- TAPPER TAPS • PIPE TAPS • STUB TAPS
- PULLEY TAPS • COLD FORMING TAPS

ALL TYPES OF SPECIALS!

FOR QUICK ACTION USE COUPON

JARVIS CORPORATION 10 Washington Park North Attleboro, Mass.

☐ Send Tap Catalog
☐ Send Tap Selector Guide

Name_____ Title_____

Company_____

Street address_____

City & State_____

ETCO MACHINES
Handle All Makes of Eyelets, Tubular Rivets and Electronic Terminals

Tubular Riveter
Model 600

Give Yourself Complete Freedom in Fastener Choice

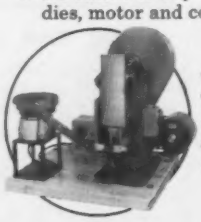
Select the fastener that does your assembly job best. Eyelet Tool Company manufactures machines to handle all makes of tubular rivets, eyelets and electronic terminals.

Let us solve your fastening problem. We will examine your fastener and work-piece and design tracks and dies to solve your problem.

For 100 years the Eyelet Tool Company has specialized in the manufacture of tools for all types of fasteners.

Check These Features

- Circuit design prevents damaging double strokes.
- Setting force in excess of 3,000 ft.-lbs.
- Separate hopper agitator motor insures continuous feed.
- Easy to change tracks for fasteners of different sizes.
- Single revolution clutch engages flywheel.
- Electric foot switch control.
- Safety overload switch protects motor.
- Throat depths up to 10½".
- No extras to buy – Unit is quoted complete with tracks, dies, motor and controls.



Turret Terminal Riveter Model 900
Turret terminal riveter for electrical and electronic industries. Inserts and sets all makes of electronic terminals and base pins.

Eyeletting Machine Model AE-101
Lower cost general purpose eyeletting machines for smaller eyelets. Electric, air or foot operated models available. All have 10½" throat.

Write for descriptive literature and specifications or send samples of fasteners and assembly to:

EYELET TOOL COMPANY, INC.
31 Carleton Street, Cambridge 42, Mass.
UNiversity 4-8170

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

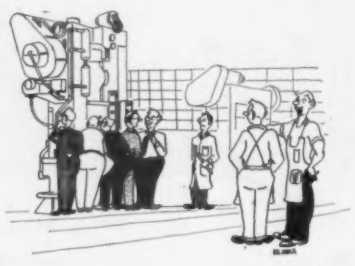
24 SMALL-DIAMETER TUBING — *J Bishop & Co Platinum Works, Malvern, Pa.* 20-page catalog 13 gives sizes, specifications, finishes, tolerances, chemistry, and applications of tubing up to 1-in. OD. One section is devoted to inspection procedures and quality control. Other sections deal with glass-to-metal sealing alloys; reactive and refractory metals; clad metals and composite wires in various forms.

25 SPEED REDUCER—*Dodge Manufacturing Corp, Mishawaka, Ind.* 4-page bulletin 602A pictures and describes a small shaft-mounted unit, latest addition to the Torque-Arm line. Reported to be the smallest available reducer of its type, the TD025 is designed for shafts 1⅛ in. or less and for power requirements up to 1 hp at 90 rpm. Reduction ratio is 24.89:1 and output speeds range from 10 to 90 rpm. Table of recommended V-belt drives permits easy selection of total speed ratios up to 175 to 1.

26 TOOL STEEL—*Dodge Steel Co, 6501 State Rd, Philadelphia 35, Pa.* 2-page Technical Data Sheet describes new Grade DTS-40, a tough, hot work steel suitable for tool use demanding a higher degree of toughness at moderately elevated temperatures than is possible with tungsten hot work steels. It is suitable for all hot work operations where drastic coolants such as water are used; it will not heat check. Also included is specific information on hardening, annealing, tempering, hardness, as well as suggested applications.

27 MOTORS—*Leland Ohio Electric Co, 1501 Webster St, Dayton 1, Ohio.* Illustrated bulletin 300 describes line of integral (1 through 5) hp capacitor-start induction-run single phase open motors. These units have starting torques from 250% to 350% and overload capacities averaging 250% of full load torque. They operate at speeds ranging from 950 through 3450 rpm and are suitable for either continuous or intermittent duty. Lists NEMA frame assignments by horsepowers and speeds.

28 SPEED CHANGERS—*Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.* Literature describes design features of the Vari-Tex available in five case sizes ranging from 1 to 30 hp designed to provide stepless speed changes within standard speed ranges of 2:1 through 10:1 at operating speeds from 1.8 to 4660 rpm. Tells how a choice of mechanical, electrical, and pneumatic control options can afford a wide degree of versatility in measuring process or product variables by means of standard sensing and signaling devices. Bulletin 51B9061B covers 4, 5, and 6 case sizes: 51B1042 deals with sizes 2 and 3. ●



AM/MM

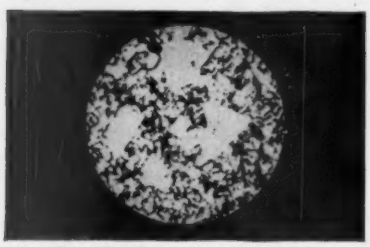
"See, after the tool is tried out and ready to run everybody gets in the act but the guy that built it can't get near it."

Linde Coatings & materials News

LINDE COMPANY, DIVISION OF UNION CARBIDE CORPORATION

Abrasives, 99.98% pure alumina, simplify polishing of metals

Once it was a complex art to put precision finishes on metals. Polishing, sharpening, honing involved many abrasives and techniques. Now, with LINDE *alumina* abrasives, metallographic polishing is routine.



Magnified 1500 X—a sample of tungsten carbide with 6% cobalt binder polished by modified procedure for hard materials. (Murakami's etch).

In three grades LINDE 0.3 A (alpha alumina), LINDE 0.05 B (gamma alumina), and LINDE 1.0 C (alpha alumina)—these low-cost, fast-cutting white powders can be used with many materials. LINDE 1.0 C removes material rapidly; LINDE 0.3 A cuts quickly, yet leaves a clear, unsmeared finish; LINDE 0.05 B cuts slower but produces a finer finish. Uniformity of the particle size eliminates levigation in finishing.

Powders can be used dry, or mixed with water or other vehicles to make a thin slurry or heavy paste, or compounded with waxes in convenient stick form. Both are highly resistant to common acids. Check, send the coupon.

Now—high workability for tungsten in crystal form

Ingots of LINDE crystal tungsten can be worked into intricate shapes for electronic, other applications. It can be done at room temperature, using standard machine tools. Metal has no porosity, relatively low impurity, is less brittle than PM tungsten. Crystal tungsten also has unusual ductility, has been drawn into wire as fine as 1 mil for greater yield of finished product from starting ingot. Check, send the coupon for details.

High-grade wear from lower-grade metals —with tungsten carbide coatings

Bearings on the torque meter shaft of a turbo-prop aircraft engine gave only 50 hours operating life, even though the bearings were heat-treated. The short life was caused by severe fretting corrosion. Then the bearing surfaces were given a tungsten carbide coating with LINDE's Flame-Plating process. Service life is now greater than 1500 hours.

A critical tolerance had to be maintained between a ball piston and the piston wall in a hydraulic pump. Carbide inserts mating with steel balls proved unsatisfactory due to differential expansion at operating temperature. Carbide balls added considerable weight. The problem was solved with Flame-Plated steel bushings which had the correct expansion rate and a wear resistance equal to solid carbide—at considerably less weight.

Aluminum toughened

In another situation, aluminum rocker arms were being used in an aircraft heater mechanism to keep weight under overall requirements. But, because of severe sliding abrasion, the relatively soft metal lasted only about 100 hours. When the wearing surface was given a precision coating of tungsten carbide, service life jumped to more than 1000 hours. And the desirable light weight of aluminum was not lost.

These are typical examples of how LINDE's custom-coating service can be used to upgrade many ordinary metal parts by coating their wearing surfaces with tungsten carbide, aluminum oxide, tungsten, molybdenum, other oxides and materials. The thin coatings multiply wear performance many times over—but at the lower costs and with the retention of the other desirable properties associated with the base metals.

If you need technical information on particular problems with wear caused by abrasion, corrosion, erosion—even under conditions of severely high temperature, high load, or absence of lubricant or cooling—LINDE can help you. Check and send the coupon below.

PHYSICAL DATA—FLAME-PLATED COATINGS

COATING DESIGNATION	LW-1	LW-1N	LW-5	LC-1A	LA-2
Approx. Composition by weight	Tungsten Carbide + 6% to 8% Co	Tungsten Carbide + 13% to 16% Co	25% WC + 7% Ni + mixed W-Cr Carbides	85% Cr_3C_2 + 15% Ni-Cr	99% + Al_2O_3 (gamma)
Hardness Vicker's (VPN_{300})	1200 to 1450	1050 to 1150 VPN 70 to 71 R.	1000 to 1200 VPN	850 VPN	1000 to 1200 VPN
Maximum temp. in oxidizing atmosphere	1000°F.	1000°F.	1400°F.	1800°F.	1200°F. to 1800°F.
Coefficient of thermal expansion	4.0 x 10 ⁶/°F. Avg. 70 to 1000°F.	4.7 x 10 ⁶/°F. Avg. 70 to 1000°F.	4.6 x 10 ⁶/°F. Avg. 70 to 1400°F.	6.4 x 10 ⁶/°F. Avg. 70 to 1800°F.	3.9 x 10 ⁶/°F. Avg. 70 to 1832°F.
Modulus of Rupture	67,000 psi	80,000 to 106,000 psi	40,000 psi	75,000 psi	22,000 psi
Modulus of Elasticity	44 x 10⁶ psi	42 to 40 x 10⁶ psi	17 x 10⁶ psi	22 x 10⁶ psi	16 x 10⁶ psi
Porosity	0.5%	0.5 to 1.0%	0.5%	0.5%	1.0%
Specific Gravity	14.2	13.2	10.1	6.54	3.45
Specific Heat	0.048	0.056	0.070	0.127	0.196
Thermal Conductivity	5.3 at 500°F.	5.3 at 500°F.	3.8 at 500°F.	4.3 at 500°F.	0.86 at 500°F.
Main features	Extreme wear resistance	Excellent wear resistance + increased resist. to mechanical and thermal shock.	Excellent wear resist. to higher temps. Improved corrosion resist.	Good wear resist. at high temp. or in corrosive media. Resists flame impingement.	Excellent resist. to wear, chem. attack and high temperature deterioration.

CHECK—CLIP COUPON—ATTACH TO BUSINESS LETTERHEAD

Linde Company, Dept. AM-103
270 Park Avenue
New York 17, N.Y.

Please send details on the items checked:

- ☐ LINDE Flame-Plated Coatings
- ☐ LINDE Alumina Abrasives
- ☐ LINDE Arc Crystal Tungsten

UNION CARBIDE

LINDE COMPANY

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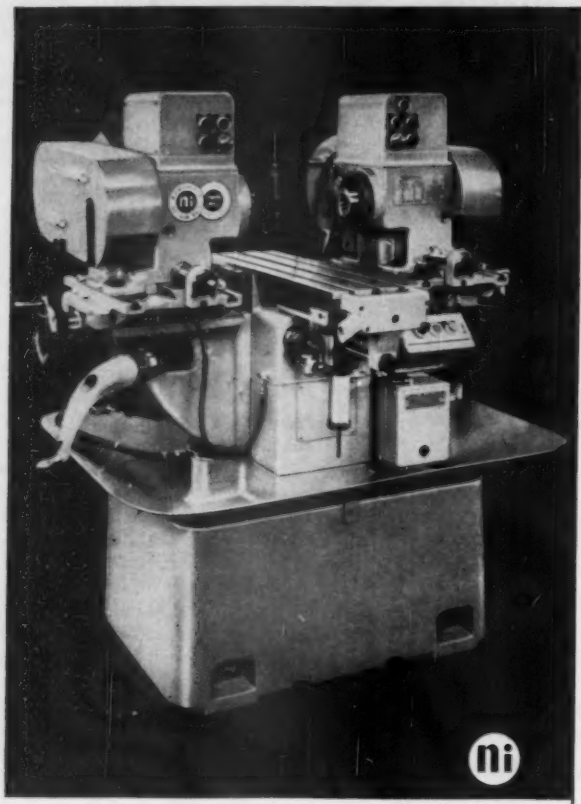
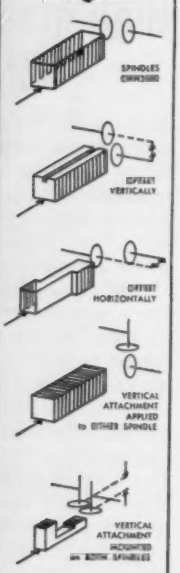
NICHOLS TWIN MILL FOR THE GREATEST VERSATILITY PER DOLLAR



ALL THESE OPERATIONS



AT THIS LOW COST

$7,830

Base price standard motor driven model, FOB Waltham, Mass.

Write for details on the complete Nichols line, "The Millers That Use Their Heads"

MANUFACTURED BY W. H. NICHOLS CO., AND NATIONALLY DISTRIBUTED BY

The ROBERT E. MORRIS Company

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Developments in interferometry are playing an ever-growing role in the search for better and more efficient inspection equipment in metalworking. There's a host of valuable data in our 16-page special report that's available for 35¢ from

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American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.

NEW FILMS...

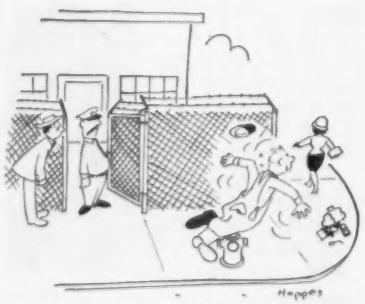
A PRACTICAL SYSTEM OF INVESTMENT ANALYSIS—THE MAPI SYSTEM. *Produced by Machinery & Allied Products Institute, 1200 18th St NW, Washington 6, DC. 35 mm slide film, color. 100 frames. Price $15 to MAPI members, $20 to non-members.*

Designed as a training film for presentation by a company executive in a one-hour group discussion session, this visual aid is accompanied by a printed script and 24-page guide which includes reproductions of the illustrative material. The purpose of the film is to aid salesmen, engineers, financial personnel, and executives who are responsible for providing information or reviewing the analyses on which investment decisions are based.

It deals with equipment replacement and discusses the factors essential to systematic analysis of investment; then it illustrates the step-by-step procedure for applying the MAPI system. Additional copies of the pamphlet are available at 25¢ each.—HEL.

BETTER GRINDING. *Produced by Landis Tool Co, Waynesboro, Pa. Film Strip, sound, color. Running time 26 min. No charge.*

Done in cartoon style, the film describes and illustrates "How to do it" for cylindrical grinder operators. It will also be of interest to grinder foremen, methods and process engineers, and training and safety directors. For projection, an automatic projector with 33 1/3 rpm turntable is required.—HEL. •

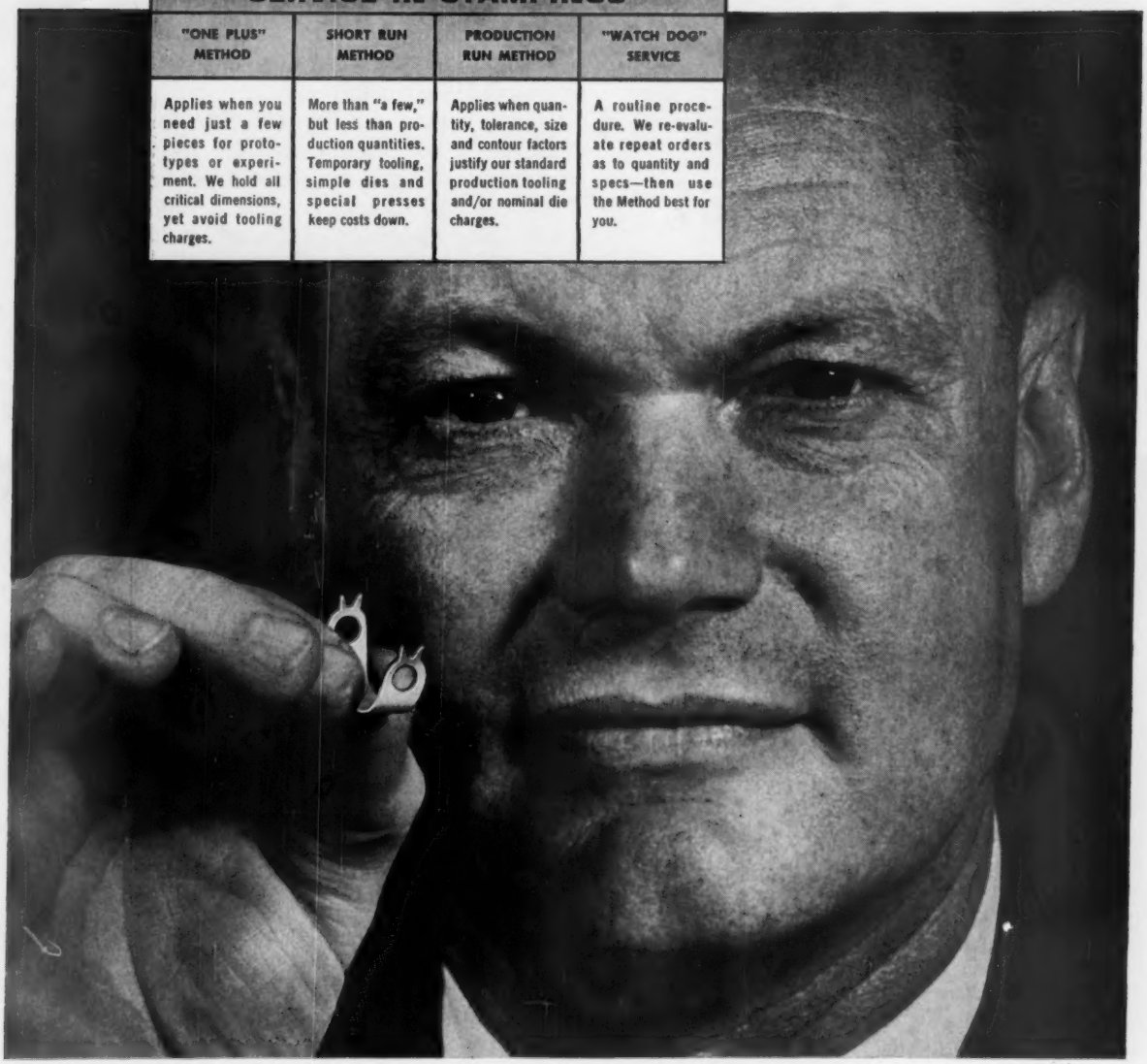


AM/MM

"The shop can pass all sorts of rules and safety regulations, but how can we protect an employee from himself?"

SERVICE IN STAMPINGS

"ONE PLUS" METHOD	SHORT RUN METHOD	PRODUCTION RUN METHOD	"WATCH DOG" SERVICE
Applies when you need just a few pieces for prototypes or experiment. We hold all critical dimensions, yet avoid tooling charges.	More than "a few," but less than production quantities. Temporary tooling, simple dies and special presses keep costs down.	Applies when quantity, tolerance, size and contour factors justify our standard production tooling and/or nominal die charges.	A routine procedure. We re-evaluate repeat orders as to quantity and specs—then use the Method best for you.



UNIQUE EXPERIENCE PRODUCES BETTER STAMPED METAL PARTS

We have been producing Stamped Metal Parts at the Laminated Shim Company, not as a sideline, but as the mainstay of our business since 1913. That's important for you to know. It is just this kind of experience and specialization that provides you with an unmatched Service in Stampings as near as your phone.

With this Service you get top quality Stampings . . . **(1)** in any size, any shape, ranging from tiny lock washers to electronic chassis to husky rocker arms . . . **(2)** in any quantity, from a single prototype to a million or more . . . **(3)** all within accepted tolerances and finishes for the class of work involved . . . **(4)** at surprisingly low cost.

So . . . for better Stamped Metal Parts, faster and at low cost, call DAvis 5-2631 or send your prints for quotes directly to the . . .

LAMINATED SHIM COMPANY, INC.,
3110 Union Street, Glenbrook, Conn.

NEW FAST DRAW TECHNIQUE CUTS FABRICATING COST OF MAGNESIUM

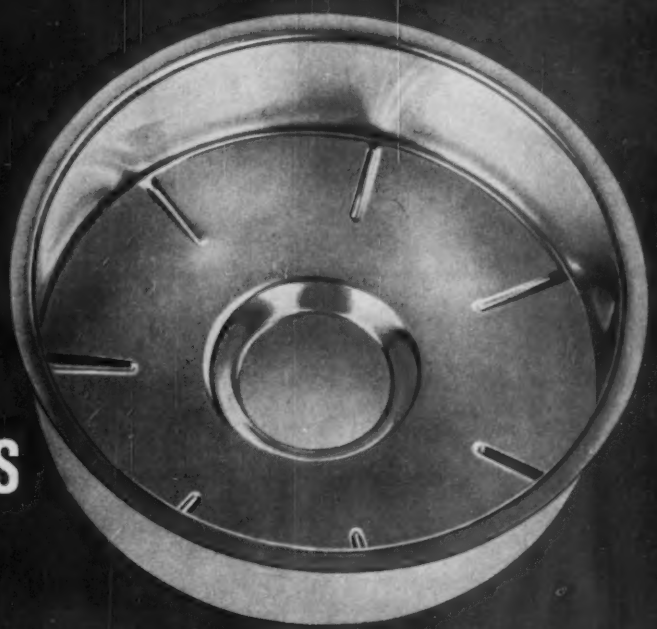
Magnesium parts are now being deep-drawn experimentally at high speeds with a newly-developed process. It uses standard mechanical presses, moderate temperatures (400°F.) and ordinary soap-type lubricants. The part illustrated below was drawn and ejected in 1½ seconds.

This technique cuts the cost of fabricating cylindrical parts of magnesium—with its unparalleled combination of light weight, stiffness and strength. Draws to a 50% reduction are made readily at normal production speeds with a minimum of die stages.

The new technique is expected to find use for many drawn magnesium parts, including components of appliances and business machines. Find out what it can do for you. Write THE DOW METAL PRODUCTS COMPANY, Midland, Mich., Merchandising Dept. 1109F10-16.

FROM BLANK...

TO PART...

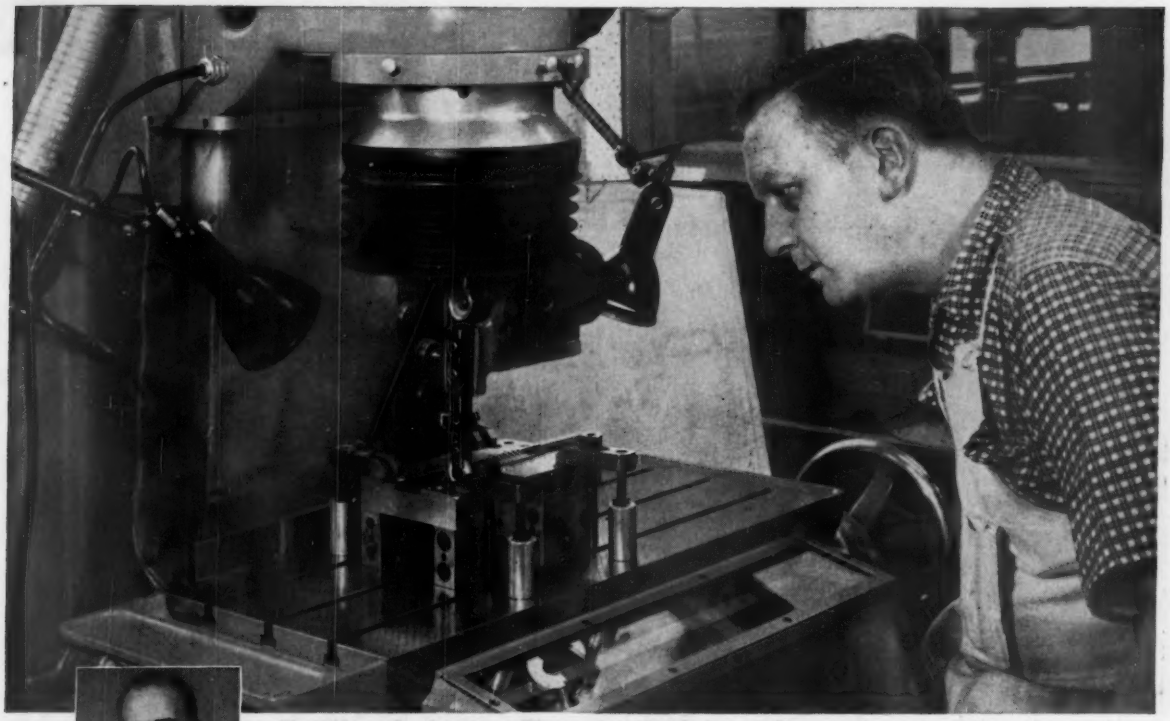


IN 1½ SECONDS CYCLE TIME

DOW **THE DOW METAL PRODUCTS COMPANY**

Division of The Dow Chemical Company

CIRCLE 448 READER SERVICE CARD



No. 3 Moore Jig Grinder at Wauconda with the slot-grinding attachment in position. Accessories like these bring out the full versatility of Moore equipment and help solve "impossible" jobs.

"Moore equipment enables us to produce millions of parts to exacting tolerances"

says Kenneth Pearson, Co-owner, Wauconda Tool & Engineering Co., Inc. Algonquin, Illinois.

"Specializing in out-of-the-ordinary, close-tolerance press and multi-slide work, it is essential for our plant to have the best toolroom equipment.

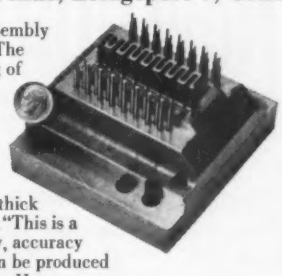
"Our Moore Jig Borers and Jig Grinders make it possible for us to do the unusual in the line of accuracy required for our precision die work and enable us to produce millions of parts to the exacting tolerances that are so essential in computer, missile, instrument and electronic components.

"These machine tools do the ordinary as well as the extraordinary, day in day out, and are in constant use. The rigidity, durability and precision built into Moore equipment makes them unequaled for our exacting requirements.

"We base our business on the premise that quality is remembered long after the price is forgotten. Moore equipment contributes in large measure to this quality."

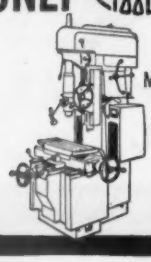
Write today for literature describing the unique features of No. 3 Moore Jig Borers and Jig Grinders.

Moore Special Tool Company, Inc.,
738 Union Avenue, Bridgeport 7, Conn.

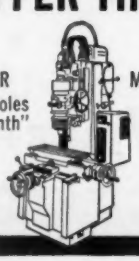


Contour grinding on a punch assembly for an intricate progressive die. The entire shaped contour, consisting of individual inserts, has been jig ground, with outside and inside radii ground in the assembled state and the straight portions ground as individual inserts. Note coin for comparative size. The stamping produced is .006" thick and must be absolutely burr free. "This is a good illustration of the versatility, accuracy and high degree of finish that can be produced on Moore equipment," says Henry Harper, Co-owner of Wauconda Tool & Engineering Co., Inc.

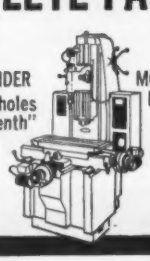
ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION



MOORE No. 3 JIG BORER
Locates and bores holes to less than a "tenth"



MOORE No. 3 JIG GRINDER
Locates and grinds holes to less than a "tenth"



MOORE UNIVERSAL MEASURING MACHINE
Measures to one-third of a "tenth"

MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

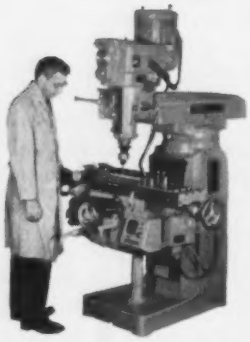
GREATEST SPEED RANGE

IN VERTICAL MILLING

65 to 4600 RPM

New GORTON VARIABLE SPEED HEAD Model 1-22 Mastermil

- The ideal head for milling high tensile strength alloys with maximum cutter efficiency.
- Remarkably smooth spindle operation throughout entire speed range from 65 to 4,600 RPM . . . insured by *unison-mechanical* change of pulley diameters, with positive control.
- Guaranteed high precision spindle of interchangeable self-contained design.
- Direct reading spindle speed dial provides fast speed selections.
- Maximum torque in low speeds through back gear design.
- Dial-type down feed—infinitely variable .250 to 4.000 inches per minute with built-in over-running clutch for feeding against positive stop.
- Traditional GORTON quality in every detail.



Write for Bulletin No. 2699 for complete description of new variable speed head and Gorton Mastermil.

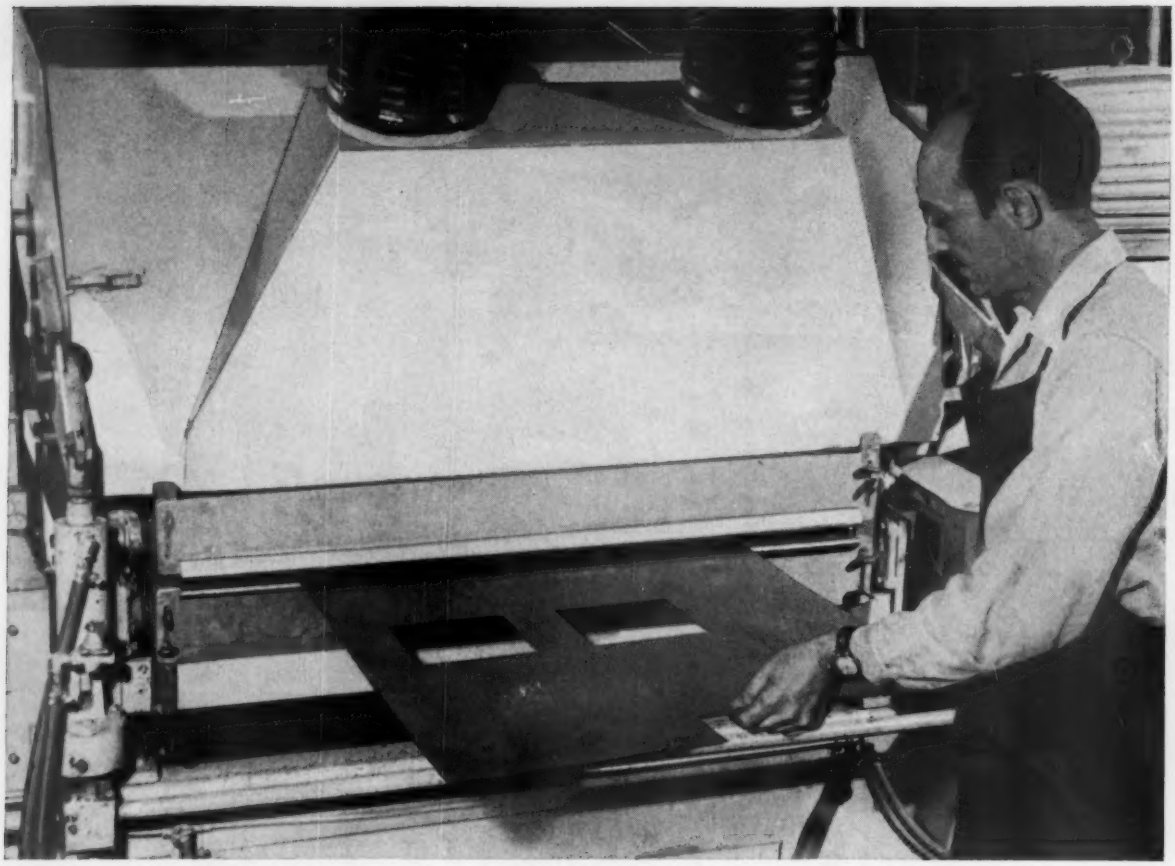
GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1510 RACINE STREET, RACINE, WISCONSIN

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems.
Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories... Defense and special products.



3M Abrasives Help AMF Reduce Sheet Metal Deburring Costs

Innumerable ferrous and non-ferrous sheet metal components are manufactured for cigarette, cigar, bakery, and Automatic Pinspotter Machines at the American Machine & Foundry's Brooklyn, New York plant. Sheared to size and punched, components must then be deburred and cleaned prior to painting and plating. The previous method, using abrasive discs, often left swirl marks which had to be removed in a secondary hand sanding operation at extra cost.

As the result of a recommendation from a 3M Representative, AMF switched to the use of a wide-belt sander and "Three-M-ite" Resinbond Cloth Belts on these operations.

The results were remarkable. The new wide-belt prefinishing method eliminated all extra re-work, provided a better pre-paint surface, and cut unit costs substantially. Unit production time was slashed from more than 9 minutes to less than 30 seconds.

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase profits. Discover . . .

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form *without obligation.* Put 3M's years of abrasive know-how at your disposal.

3M Coated Abrasives

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COST CHECK 5-4-5

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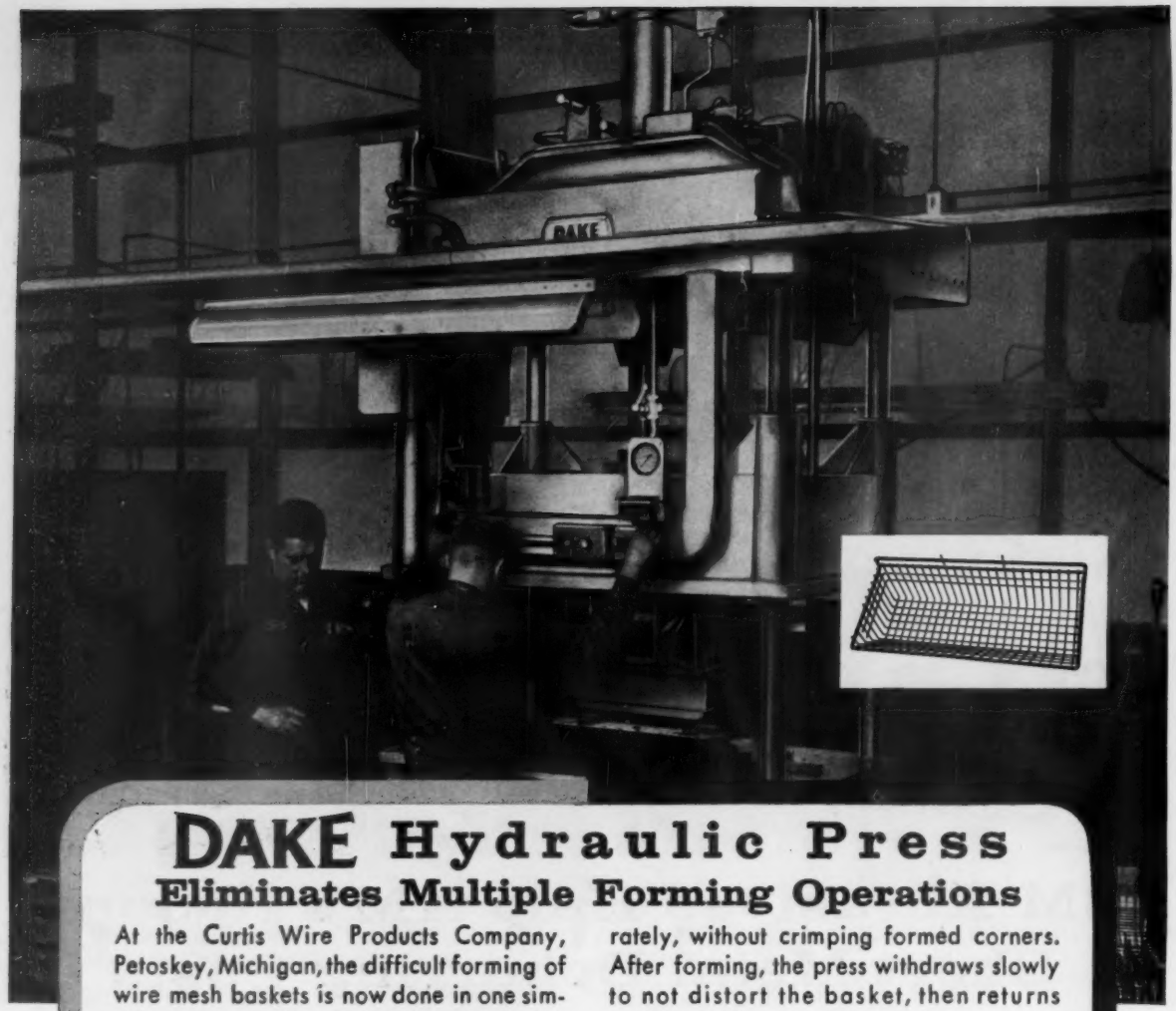
MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

"3M" AND "THREE-M-ITE" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.



DAKE Hydraulic Press

Eliminates Multiple Forming Operations

At the Curtis Wire Products Company, Petoskey, Michigan, the difficult forming of wire mesh baskets is now done in one simple operation with a Dake 50-ton *Hydraulic* Guided Platen Press. The Dake Press saves considerable production time per basket by eliminating previous operations which formed only one side at a time.

The preset cycle of the Dake Press eliminates any possibility of operator error. After the wire mesh is placed in the die, the operator presses dual palm buttons which close the press rapidly until just before the wire mesh is contacted. It then slows to an adjustable pressing speed and forms the material smoothly and accurately, without crimping formed corners. After forming, the press withdraws slowly to not distort the basket, then returns rapidly to the top of its stroke.

Every feature of a Dake Press is designed to save production time. The press stroke may be set to eliminate unnecessary travel. Rapid advance and rapid return increase the pressing cycle. Large bed area with ample daylight provides easy insertion and removal of pressed parts.

Dake Presses are available in capacities from 25 to 600 tons. For special applications, investigate the Dake line of Custom-Engineered Presses. Write for Catalog.

DAKE CORPORATION 636 Robbins Road, Grand Haven, Mich.

DAKE PRESSES

Arbor Presses

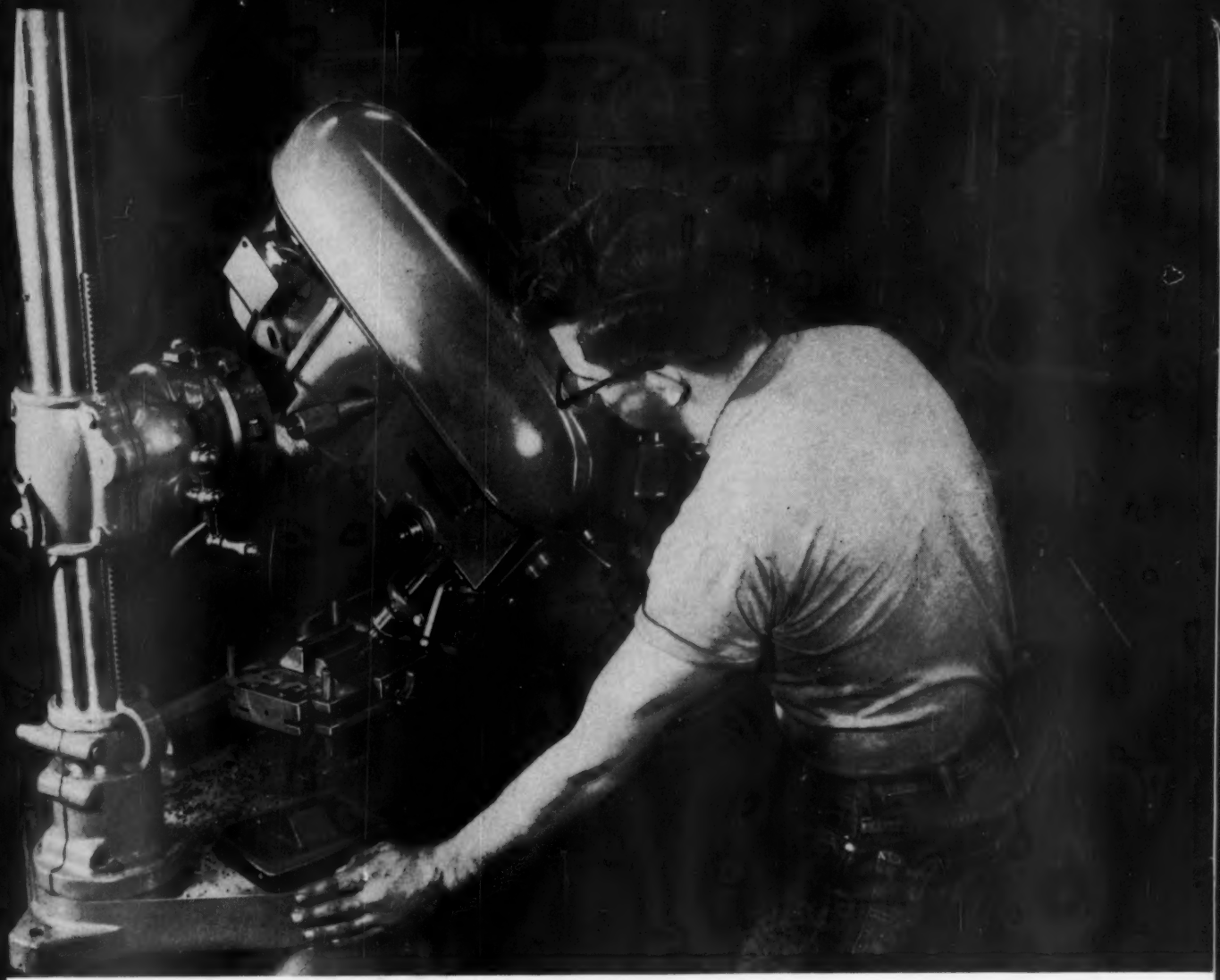
Hand-Operated Hydraulic

Power-Operated Hydraulic

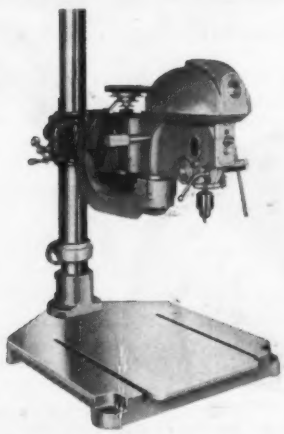
Guided Platen

Gap Type Presses

Movable Frame



Position the tool—not the work with this new Delta Unidrill*



New Delta Unidrill line is available in bench and floor models or as components for custom assembly. Choose Utility or Deluxe Head, High or Slo Speed, Key Chuck or Tapered Spindle.

FREE BROCHURE catalogs full Radial Drill Press line. Write: Rockwell Manufacturing Company, Delta Power Tool Division, 518K N. Lexington Ave., Pittsburgh 8, Pa.

It's the unique double-swivel design that gives this new 2-foot arm radial drill press such big job capacity—in metal or wood. You can do more jobs faster and easier because you can move and tilt the drill head—position the cutting tool to the work in five different ways! This saves the cost of expensive jigs and cuts time-consuming shifting of the work.

You can drill to the center of a 48" circle—on or off the table. And with six interchangeable spindles or spindle adapters, you can change in seconds to handle reaming or spot facing of metal, routing or planing of wood, and many other jobs.

The only way to see how the Unidrill can solve *your* drilling problem is to see this flexibility in *action*. Your Delta Industrial Distributor (under TOOLS or MACHINES in the Yellow Pages) will gladly demonstrate. Call him.

**Trademark*

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE 453 READER SERVICE CARD

IDEAL

LIVE CENTERS

meet most turning needs at lowest center point cost

UNIVERSAL models for super accuracy to .0001, high load capacity, perfect for grinding and other high-precision work.

MULTI-DUTY models for general use, perfect for light work, interchangeable parts provide quick changeover for multi-purpose operations.

HEAVY-DUTY models for extra rugged work, give close tolerance results where high load capacity is required, accurate to .0002.

PIPE POINT models for cylindrical turning of pipe, axles and other hollow shapes, six sizes from 3¼" to 7½" dia.

Over 40 sizes...with all popular tapers... in four styles...to choose from. That's how Ideal helps you meet your turning needs for the heaviest work to the lightest of light jobs.

Ideal Live Centers are guaranteed to provide the highest accuracy required, exactly matching the lathe size you use. What's more, they are custom quality designed and manufactured by production methods to give you the lowest possible precision center point costs.

You can get Ideal Live Centers from your distributor's stocks. He'll give you *immediate delivery service*—which reduces your inventory requirements and cuts your investment costs. If you need a special, we'll be glad to work with him to meet your specifications at the *right* price.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS
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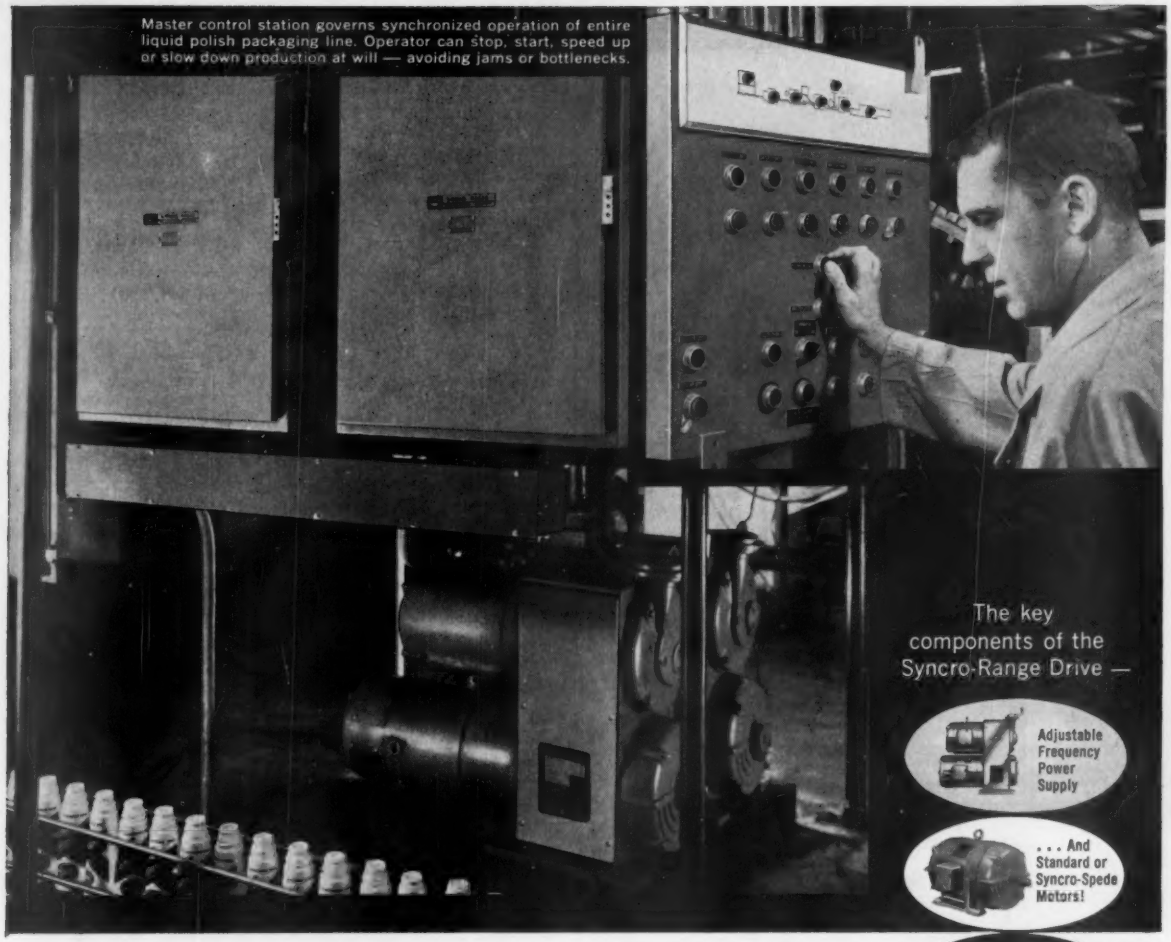
Write for new LIVE CENTER Catalog

IDEAL INDUSTRIES, Inc., 1057J Park Avenue • Sycamore, Illinois


Master control station governs synchronized operation of entire liquid polish packaging line. Operator can stop, start, speed up or slow down production at will — avoiding jams or bottlenecks.
The key components of the Syncro-Range Drive —
Adjustable Frequency Power Supply
. . . And Standard or Syncro-Spede Motors!

LOUIS ALLIS SYNCRO-RANGE DRIVES automate liquid polish lines

Johnson's Wax, renowned wax and polish producer, uses Syncro-Range Drives for exact control of process lines

Controlling the speed of the precise, mass-production lines for their new, highly successful liquid shoe polish was the task Louis Allis engineers had to solve for Johnson's Wax.

The problem was to time the flow of plastic bottles, liquid polish, wool daubers, and caps into the packaging lines at precisely equal rates. Flow rate must be adjustable so the lines can be slowed down or speeded up. And the entire packaging operation must be controllable from a single master control. The Louis Allis Syncro-Range Drive solved the problem.

Syncro-Range Drive provides synchronized speed of any number of motors from a single control. It is a "packaged system" comprising an adjustable frequency power supply operating on 3 phase, 60 cycle power input . . . a group of Syncro-Spede® synchronous motors which maintain exact synchronism regardless of varying load . . . and a control which permits the speed of the entire group of motors to be simply adjusted without losing synchronization. On applications for which exact synchronism is not required, standard squirrel cage motors can be supplied.

You can readily see the advantages of the Syncro-Range Drive in systems or processes which require synchronized movement: multiple conveyors which feed consecutively; transfer lines; process lines; assembly lines requiring coordinated arrival of components; printing where one press feeds another; synthetic fibre spinning, drawing, or twisting; metal runout tables; and other similar machines which require the application of power at a number of points on the machine.

The Syncro-Range Drive is available with a choice of drive sizes to efficiently control from 2 to 200 motors. Control features are available to provide speed regulation accurate to 0.1% with 0% relative speed difference between motors! A trained Louis Allis motor application engineer is available to help. You can reach him at your local Louis Allis District Office, or by writing to The Louis Allis Company, 452 East Stewart Street, Milwaukee 1, Wisconsin.

A5B-232

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

FOR THE MECHANIC WHO WANTS THE BEST TOOL

NEW WILSON VERTICAL PNEUMATIC GRINDERS

Wilson Series 923 vertical grinders are excellent for flash removal, snagging, weld smoothing and other metal removing operations. These powerful grinders are particularly suited for metal removal in deep cavity molds and other hard-to-get-at places. Available in threaded spindle and collet chuck models.

All Wilson portable pneumatic production tools are lightweight, compact. **• Catalog PT-58 gives all the facts. Write for your copy.**

TW816

THOMAS C. WILSON, INC.
21-11 44th Avenue, Long Island City 1, New York
BETTER TOOLS FOR BETTER WORK

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DRILLUNIT *Solves* Drilling Problems

Flexible-Dependable

Self contained —Compact,—can be mounted in any position or angle, in a small area.

Single or Multiple spindle applications, can be adapted for Drilling, Reaming, Chamfering, Boring, Counter Boring and Spot Facing.

Stroke and feed variations obtainable without changes in the unit.—Step feed drilling possible with slight modification.

9" and 12" stroke —up to 5 H.P.

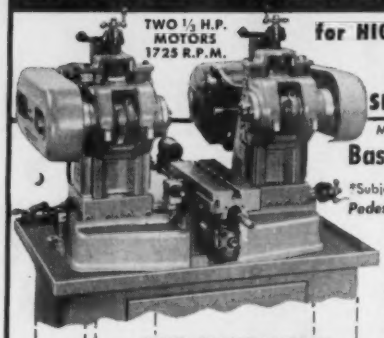
Standard Models Available from Stock

Write for literature.

DRILLUNIT, INC.
HYDRAULIC DRILL UNITS
3267 Wight Street • Detroit 7, Michigan

CIRCLE 457 READER SERVICE CARD

BARKER DUAL-HEAD MILLING MACHINE



for HIGH PRODUCTION MACHINING OF TWO SURFACES SIMULTANEOUSLY

MODEL PMD

Base Price $875.00*

*Subject to change without notice.
Pedestal & Power Feed Extra

Stepped pulleys permit a variation of speeds on the two spindles to accommodate the proper cutter for the milling operation desired.

Designed to utilize advantages of carbide tools.

BRIEF SPECIFICATIONS

- SPINDLE SPEEDS — Standard 1000-1725-3000. Nine lower speeds by using (optional) Low Speed Drive. Special Motors for still higher or lower speeds.
- DISTANCE BETWEEN SPINDLE FACES—2½" Min.—5¾" Max.
- TOP OF TABLE TO CENTER LINE OF SPINDLE—1⅜" Min.—4⅜" Max.
- HEAD—Heavy, rigid construction 3¼" travel.
- TABLE—4" x 12" working surface—½" T slot—5" longitudinal travel.
  Can be Hand, Screw Feed or Air-Hydraulic Operated.
- SPINDLE—Nickel Steel. Takes standard collets from 1/16" to ½".
  Collet draw tube takes ½" dia. stock.
- ADJUSTABLE STOPS.

WRITE FOR COMPLETE DATA ON THIS MILL AND OUR LARGER MODEL A.M.D. DUAL MILL.

BARKER ENGINEERING CO.
DIVISION
THE F. HOHLFELDER CO.
26470 Lakeland Blvd. • Cleveland 32, Ohio

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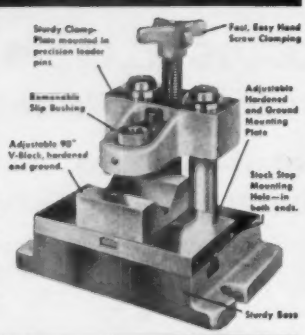
REPCO *Time-Saving Tools*

ADJUSTABLE V-BLOCK DRILL JIG

Saves Set-Up Time— Increases Output

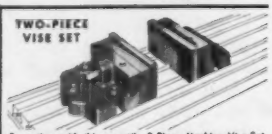
Here is a versatile and accurate V-Block that makes center and off-center drilling, tapping, and reaming easy and precise. Four-way V-block adjustment simplifies handling a wide range of work. Fast, easy positioning and clamping speed production. A centering locator plug and T-slots in the mounting surface plates assure fast, easy, on-center adjustment. Drill capacity #80 to ⅝" diameter. Handles stock from ¼" to 2" diameter.


Sturdy Clamp-Plate mounted in precision loader pins
Fast, Easy Hand Screw Clamping
Removable Slip Bushing
Adjustable Hardened and Ground Mounting Plate
Adjustable 90° V-Block, hardened and ground.
Stock Stop Mounting Hole—in both ends.
Sturdy Base

TRUE-CENTER ADJUSTABLE TOOL HOLDER

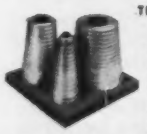
The REPCO Adjustable Holder is a precision-built tool, having two-piece construction which provides fast adjustment of the main body to compensate for as much as ⅛" machine misalignment. Cuts down on tool wear, breakage, and scrap.

TWO-PIECE VISE SET



Save time with this versatile 2-Piece Machine Vise Set. Use as general-purpose vise, angle-block, or separate clamping device. Opening limited only to length of machine base. Light, accurate, rigid. Two sizes: 6" and 8".

CHUCK JAW TRUING-RING SET



This Ring Set saves time, cuts cost of boring jaws. With correct diameter rings at hand, you gain hours of productive time. Plated rings range from 1" to 4" by ⅛" increments. Handy peg-type rack keeps rings in place.

COMBINATION LIVE-CENTER SET

Heavy-duty live center plus six interchangeable adapters, ranging from a point to 6⅛" dia. ball. Saves costly set-up and machining time necessary to make large-diameter centers. Straight and various taper shanks available.

Write for complete information—Exclusive agent territories open.

REPCO ROCKFORD ENGINEERED PRODUCTS CO.
2330—23rd Avenue • Rockford, Illinois

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SEE OUR EXHIBIT AT THE
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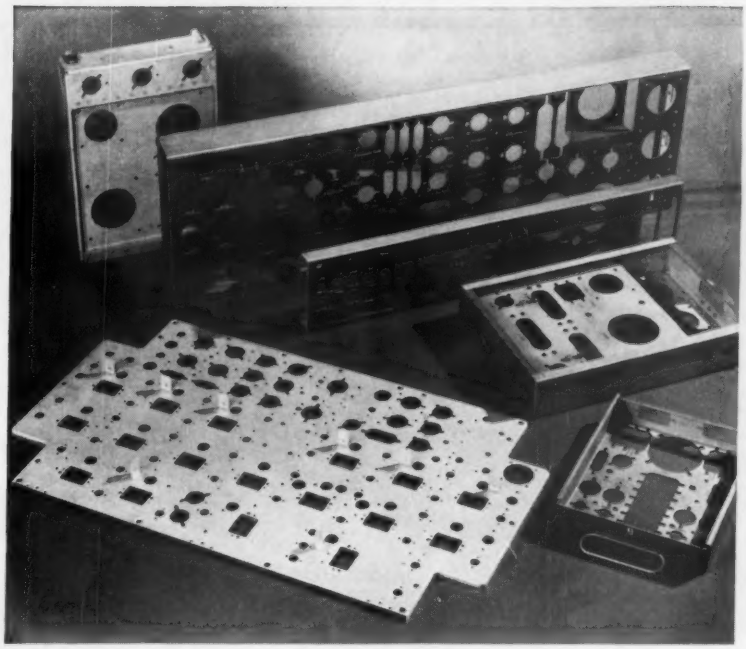
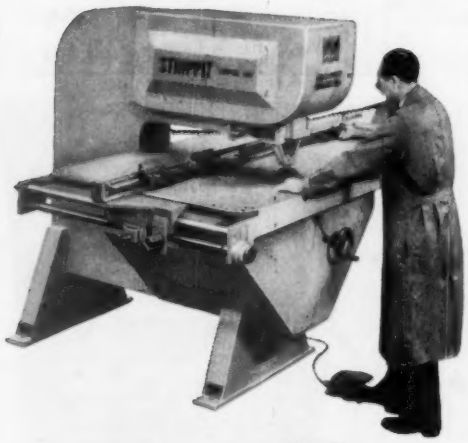
DETROIT METAL SHOW
OCT. 23-27

COME AND SEE US AT BOOTH 130



PUNCH COMPLICATED PATTERNS FAST WITH STRIPPIT FABRICATORS



SUPER 30. Handles flat or formed workpieces 60″ wide...any length. Both the Super 30 and the 15A punch round and shaped holes up to 3½″ diameter, to ¼″ thick material...notch 90° corners—rectangular, radii, vee and special shape edge notches —up to ⅛″ capacity...nibble straight line or contour shear up to 38″ diameter circle, at 165 strokes a minute in ⅛″ material.

STRIPPIT DUPLICATOR
For low cost production runs on the Super 30 or 15A, the STRIPPIT Duplicator functions like a pantograph to reproduce any hole pattern from a drilled or punched template. No custom dies needed to turn out precision sheet metal parts.

NEW 15A. Designed for workpieces up to 30″ wide...any length...the new 15A Fabricator offers all the speed and accuracy of the Super 30. Each machine, with its own universal tool holder, makes it possible to interchange standard and special tools in seconds to minimize down-time. Flat punched parts produced require no deburring. Multi-stop micrometric gaging system positions work rapidly to exact layout specifications.

WALES **STRIPPIT** INC.
200 Buell Road • Akron, New York

A UNIT OF HOUDAILLE INDUSTRIES INC.

In Canada: Strippit Tool & Machine Company, Brampton, Ont.; In Continental Europe: Raskin, S. A., Lausanne, Switzerland; In the British Isles: Kearney & Trecker—C. V. A. Ltd., Hove, Sussex, England

NOW HIGH QUALITY, PRECISION, DOUBLE PURPOSE LATHES

Cazeneuve specializes exclusively in the design and construction of high quality lathes. The superior craftsmanship reflected in each Cazeneuve Lathe is known and respected the world over.

The design which has contributed to the Cazeneuve reputation, permits optimum accuracy in both tool room and production line applications. The Cazeneuve Lathe removes metal with high precision on a wide range of jobs with the speed and ease that increases efficiency to its maximum—reduces operator fatigue to a minimum.

Here are just a few outstanding features:

- TRACER ATTACHMENT repeats within .0004". TAPER ATTACHMENT also available.
- Patented 4 way tool turrets are accurate to .0005 inches.
- All shafts are mounted on anti-friction bearings.
- Ground lead and cross feed screws.
- All moving parts are automatically pressure lubricated.
- Diagonal bridging bed construction.
- Induction hardened ways and gears.

Write, phone or wire for complete specifications

CAZENEUVE LATHES, INC.

945 E. LINDEN AVENUE, LINDEN, N. J. • WA 8-4940

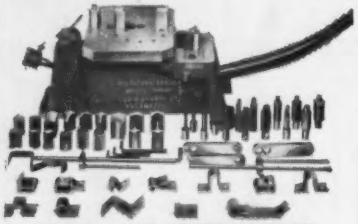
CIRCLE 461 READER SERVICE CARD

"AND IT MUST BE ROUND WITHIN FULL INDICATOR READING"

With dimensional tolerances on parts steadily being reduced, roundness determination is a continuing concern to manufacturing men. Here's a 12-page compendium of up-to-date opinion, advice and methods on roundness reprinted from American Machinist/Metalworking Manufacturing. Priced at 35¢ a copy (less in bulk quantities) it's available from

Reader Service Department
American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.

MultiformM Bends Cuts Punches



HAND, AIR, HYDRAULIC BENDING MACHINES TWENTY-FIVE MODELS

For all kinds of materials, *Round or flat up* to ½" by 8" steel.

COMPLETE EQUIPMENT for making

MetlformM LOW COST BLANKING DIES

ELECTROMATIC DIE SAWS,
MULTIFORM STEEL BENDERS,
MULTIFORM STEEL BRIDGERS,
ATLAS ALL STEEL CUTTERS,
LIGNOSTONE, LIGNITE, DIE BLOCKS,
METLFORM STRIP STEEL PUNCHES,
EJECTING RUBBER, DIE SETS, ETC.

BOOTH 1263 METAL SHOW, COBO HALL

J. A. Richards Co. Kalamazoo, Mich.

CIRCLE 462 READER SERVICE CARD

PRECISION SET-UP FOR PRECISION GRINDING WITH

ANTON MAGNETIC ADJUSTABLE V-BLOCK

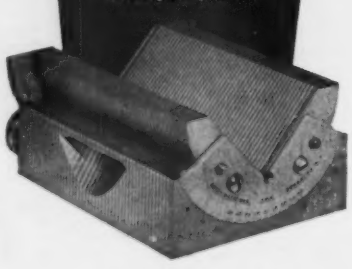
Unsurpassed for layout, toolroom and production. Can be used on any machine equipped with magnetic chucks.

SAVE MONEY, TIME AND LABOR

- Vernier accuracy: ±15 seconds
- Parallelism: ±.00005 over entire length
- Size: 8" long, 4½" wide, 2½" high

Write today for complete technical data to:

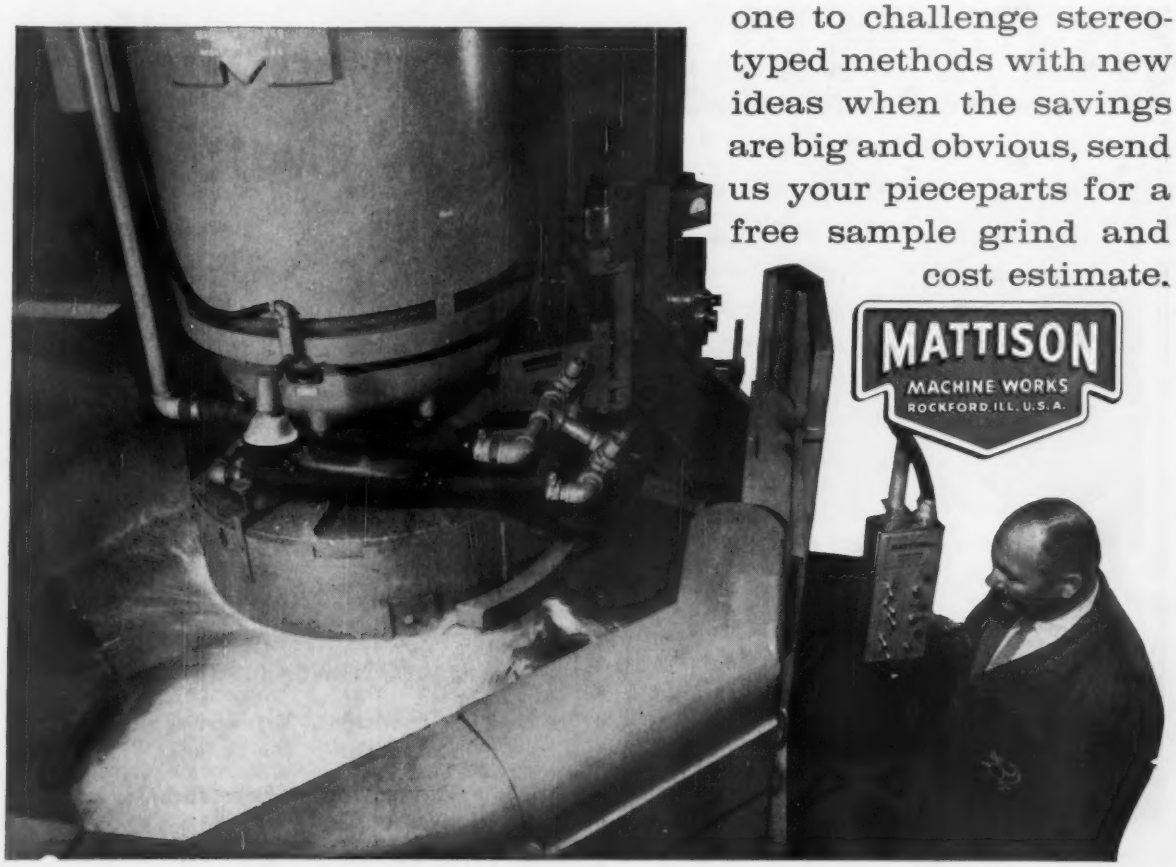
ANTON MACHINE WORKS
1226 Flushing Avenue
Brooklyn 37, N. Y.



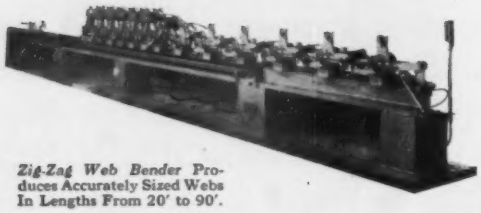
CIRCLE 463 READER SERVICE CARD

A stock-removal machine that sharpens its own cutters

Use of self-dressing wheels on a Mattison high-powered surface grinder is one easy way to get more productive minutes out of every machine hour . . . far more than the average obtained from conventional methods of flat machining. Time required for servicing a grinding wheel is almost nil. This is one of the major reasons many plants are switching to ABRASIVE MACHINING —reducing stock allowances to save material costs—grinding from the rough to increase quality and efficiency. Other important savings from stock-removal grinding accrue from faster setup and easier part handling with magnetic chucks . . . plus competitive machining time on a grinder. Tool problems caused by burned edges, hard spots, or outer scale are eliminated. Today's grinding wheels offer both high stock removal and throw-away economy. Switching flat milling, shaping, and planing jobs to a high-powered surface grinder (we're putting 200 hp on some models) is an established trend in metalworking. So, if you are one to challenge stereotyped methods with new ideas when the savings are big and obvious, send us your pieceparts for a free sample grind and cost estimate.



NOW YOU CAN MAKE A ZIG-ZAG® WEB IN JUST 60 SECONDS*



Zig-Zag Web Bender Produces Accurately Sized Webs In Lengths From 20' to 90'.

The Zig-Zag Web Bender obsoletes every other method of producing webs for joists by bending webbing faster and with greater accuracy.
One or two men can operate the Zig-Zag Web Bender and produce several times the output possible with old fashioned bending.
Depth, pitch and radius of bends are precise and consistent in their precision in every bend, resulting in fewer slow-ups on the welding line.
For complete technical details on the Zig-Zag Web Bender write to:

*10' Long—16" High—12" Pitch

National Bending Machinery Corp.
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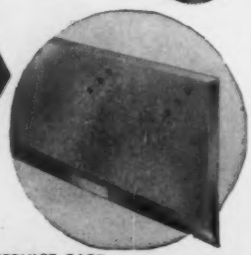

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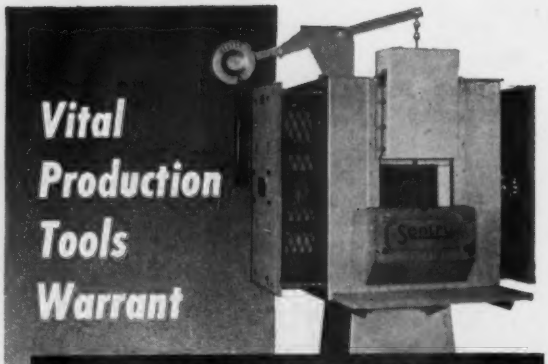

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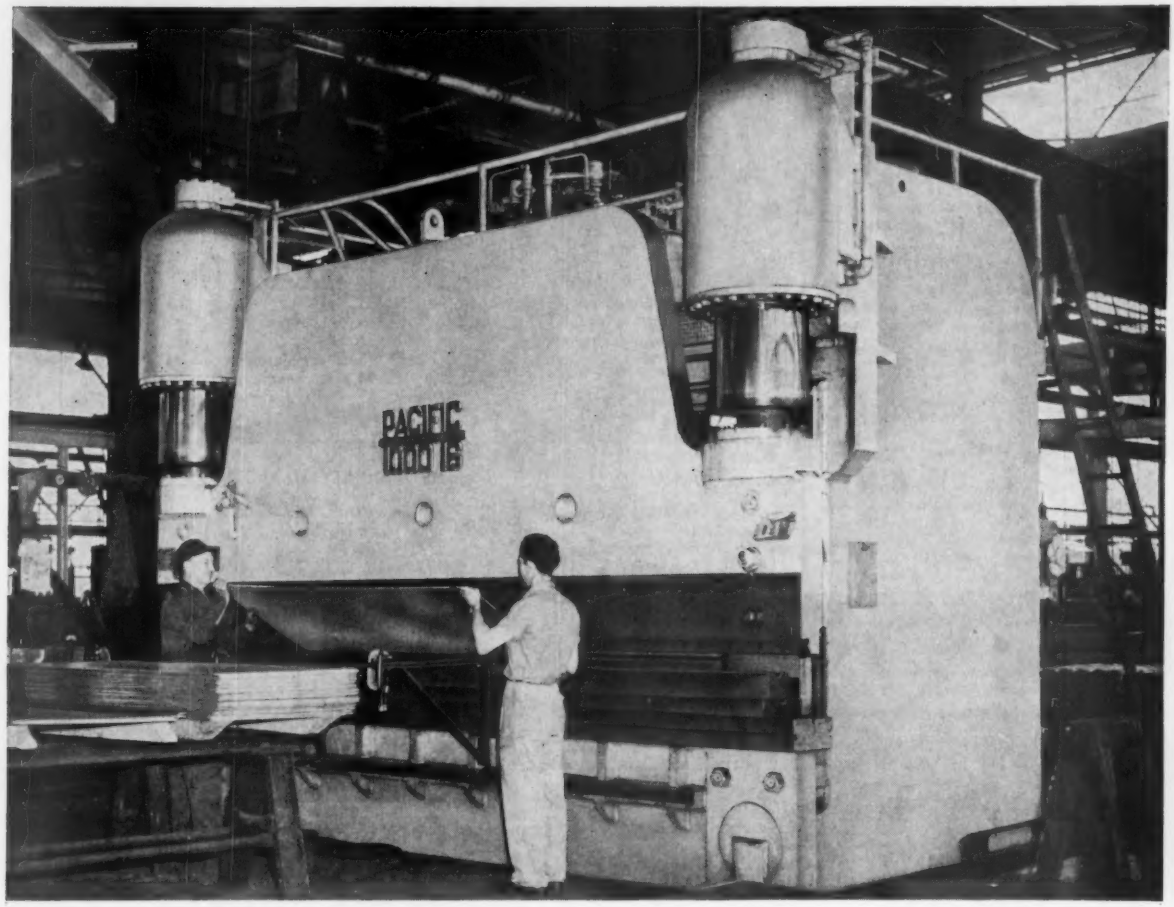

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Mill: No. 2 BROWN & SHARPE Vert. M.D.
Mill: No. 3V VAN NORMAN Ram Type Vert.
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SEARCHLIGHT SECTION

ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

3. Automatics
7. Boring Mills
8. Broaching Machines
17. Drilling & Reaming Machines
25. Gear Cutting Machines
26. Grinding Machines
30. Keyseaters
31. Lathes
33. Machine Tools
37. Milling Machines
42. Planers
45. Press Brakes
46. Presses
53. Saws
56. Shapers
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58. Sheet Metal Machinery
64. Tool Room Equipment
69. Plants & Properties

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Wigglesworth Machinery Co.	275	46

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10/16/61

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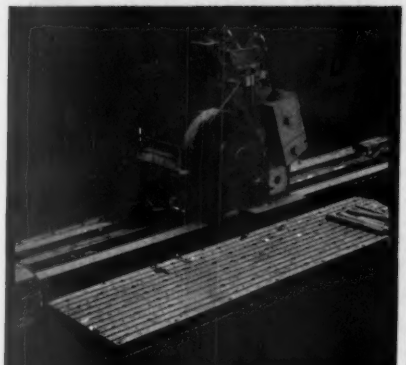
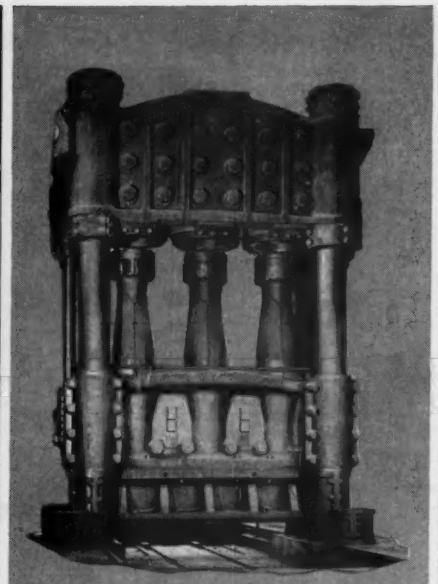
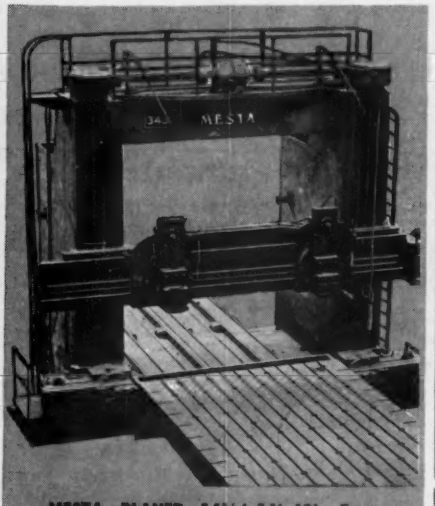


NEWTON 120"x46' Combination Rotary Planer & Cold Saw.



14,000 Ton MESTA PRESS 3 cyl. Water, 18' Daylight, Dist. Bet. Cols. 19'x8'6", Stroke 7'6", 6300 PSI Hydro-Pneumatic Operation Transf., Starting Equip., & all Misc. Aux. Equip.



MESTA PLANER 14½'x14'x42'. Four Heads, 150 HP Variable Voltage Drive.

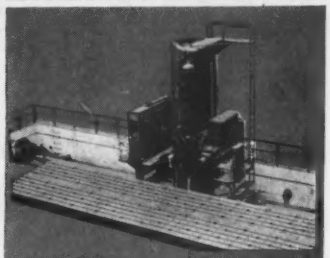
NILES PLANER 15'x14'x36', Four Heads, 150 HP Variable Voltage Drive.

6,500 Ton MESTA PRESS Down Moving Hydraulic Bending, 4 Rod Type, with Self Contained Pumping Units, Bed arranged with hydraulic front to rear travel to facilitate loading and unloading if desired. Bed 15'x15', ram 7'16"x 16' stroke 60", daylight 84", diam. of rods 24".

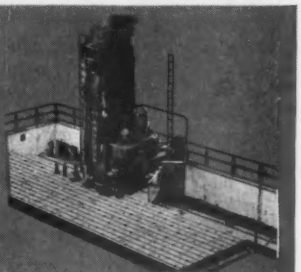
3,000 Ton BLISS Hydraulic PRESS. CLEARING Model H-3000-60, 18" Stroke, Bed 60"x7'4", 1952.

No. 1301-5 BLISS Brass & Alum. Slab SHEAR. Line Capacity 2¼"x20", 2"x 24" Brass with Pack Storage Conveyor. New 1952, Never Used.

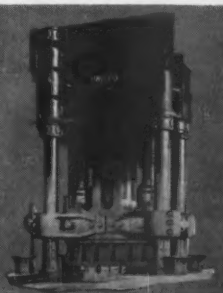
6,500 Ton UNITED ENGINEERING Water PRESS, Stroke 10', Daylight 19'4", Dist. Bet. Cols. 18'5"x7'4", 4500 PSI Hydro-Pneumatic Accumulator System with Pumps, Pressure Vessels, Transf. Starting Equip. & all Misc. Aux. Equip.



INGERSOLL 12'x46' Universal Traveling Housing Type Boring & Milling Machine.

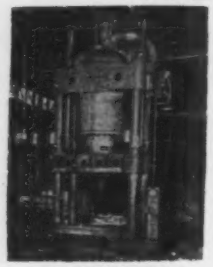


MORTON Universal Combination, Boring, Drilling, Milling Machine and Draw Cut Planer. 13'x46', 10¾" Spindle.



14,000 Ton UNITED ENGINEERING PRESS, 4 col., 2 Ram Type Water, Stroke 10', Dist. Bet. Cols. 23'x11'6", Daylight 22' 4500 PSI Hydro-Pneumatic Accumulator Syst. with Pumps, Pressure Vessels, Transf., Starting Equip. Misc. Aux. Equip.

• HYDRAULIC PRESSES •



1000 TON WATSON STILLMAN

Down moving, 4 column with pullback cylinders and safety head
Bed area: LR 62, FB 60
60" Daylight, 48" Stroke
32" ram diameter, 9" columns, 21" x 63" between columns.
60" x 60" top platen, self-contained, 75 Hp 2500 psi, 6' x 8' floor area
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60" max. ram, 14" ram diameter, 2600 PSI operating pressure.
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Bed Area: LR 36", FB 36"
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6' x 4' floor area, 15' high

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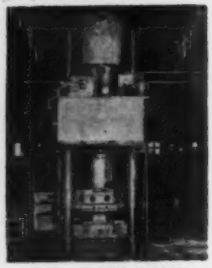

750 TON BALDWIN SOUTHWARK

Down moving, 4 column with pullbacks
Bed area: LR 53", FB 42"
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25" ram diameter, 9" post diameter, 53" x 31" between columns.
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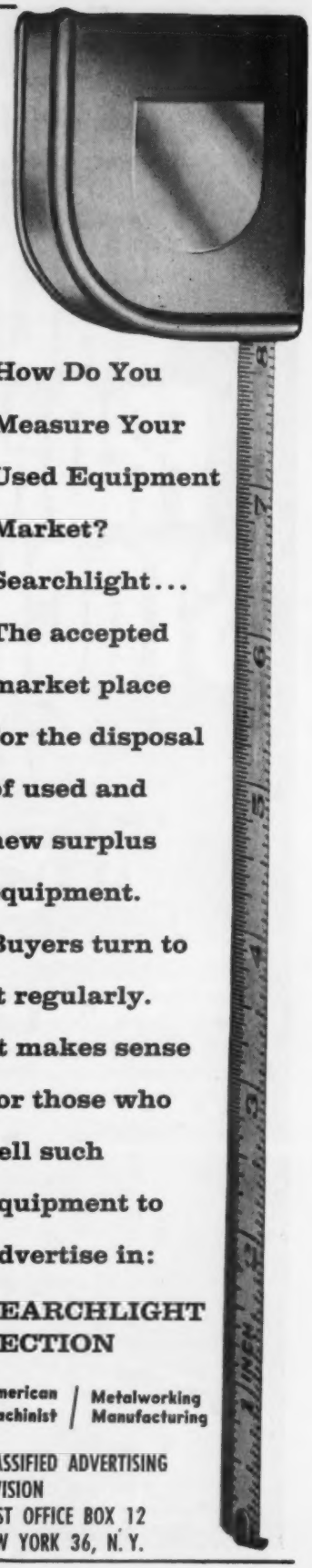
(My commission expires March 30, 1963)



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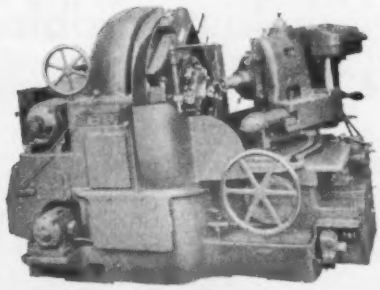

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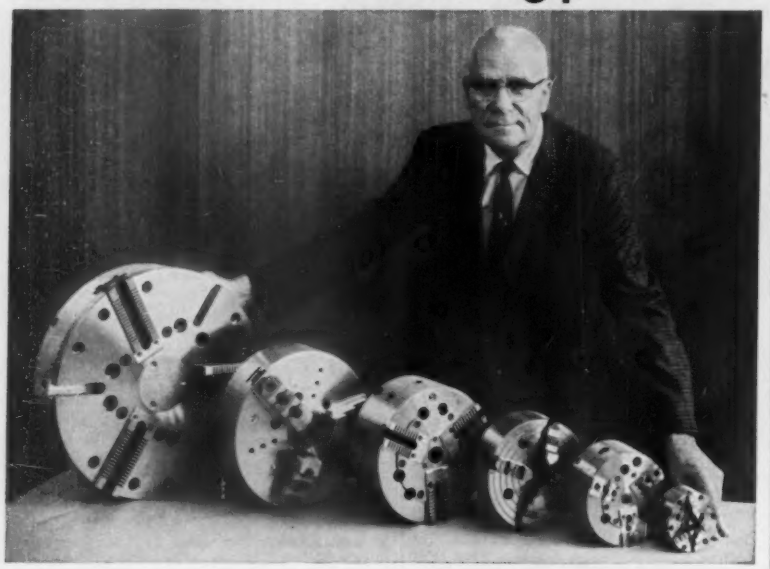

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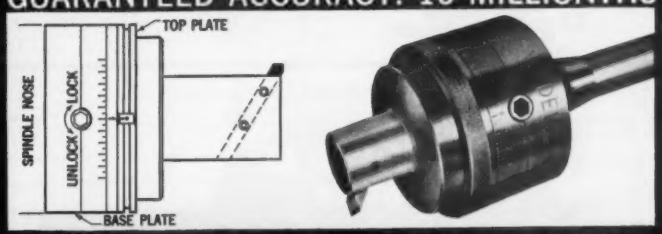

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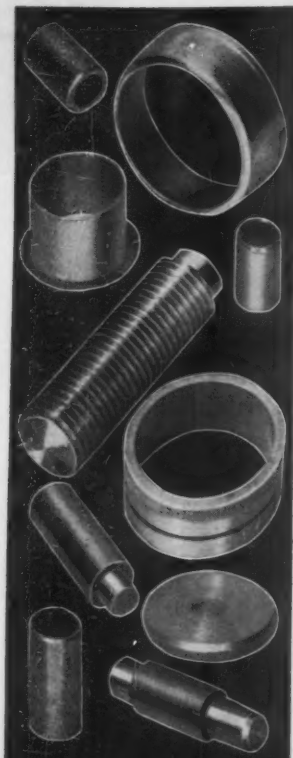

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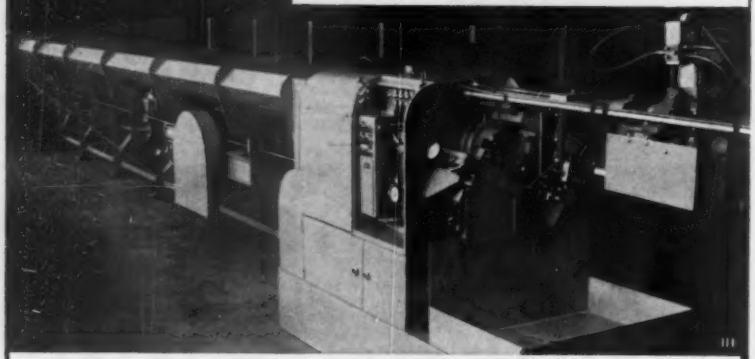

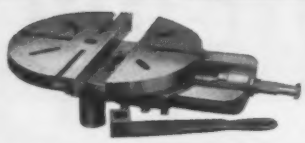

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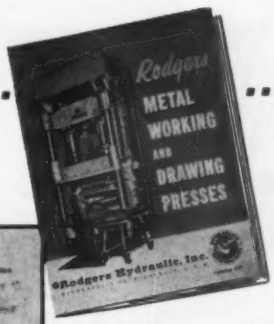

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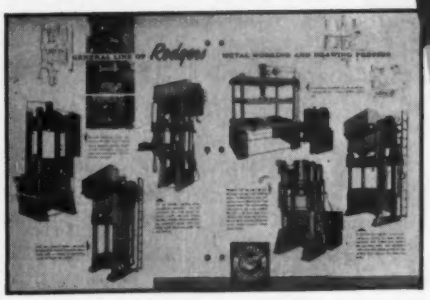

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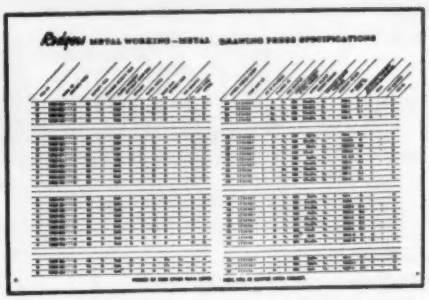

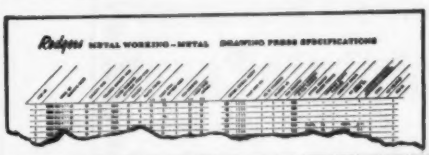

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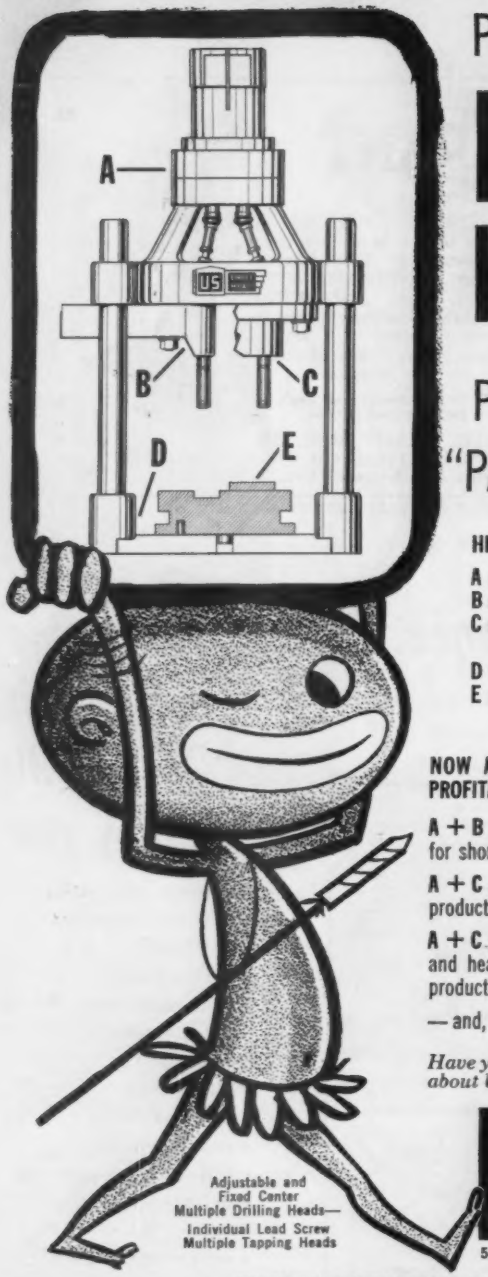

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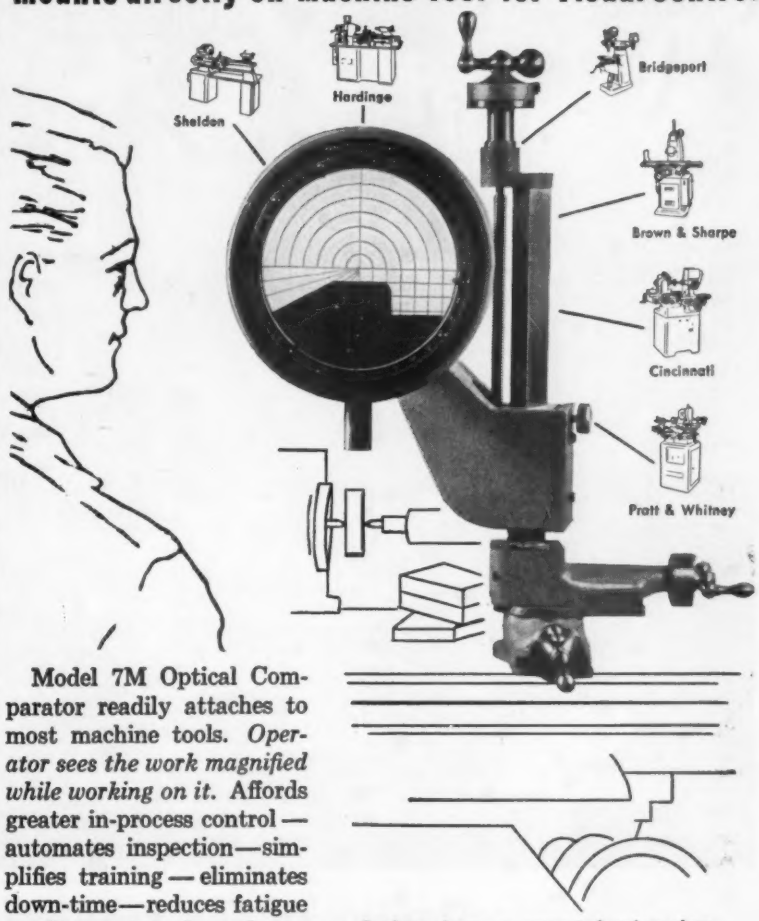

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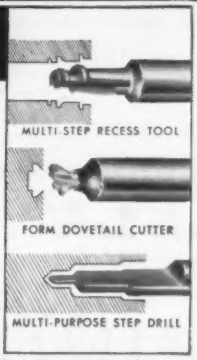
Woodruff & Stokes specializes in solving small cutting tool design problems. Years of tool engineering and a comprehensive knowledge of multi-operational tools enable us to solve your special tool problems faster and at less cost. W & S has designed small tools that combine five machining operations in one. Many of your machining operations might well be simplified or combined by use of special tools already developed by W & S. Our stockpile of solutions represents a short cut in time and lower tool cost for you.

Write today for information on W & S tools, or for recommendations on special tool design problems.



WOODRUFF & STOKES CO.
INCORPORATED
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Center Drills • Hollow Mills • Trepans • End Mills • Hexagon Broaches
Recessing and Back Chamfering Tools for Screw Machines • Spline Broaches

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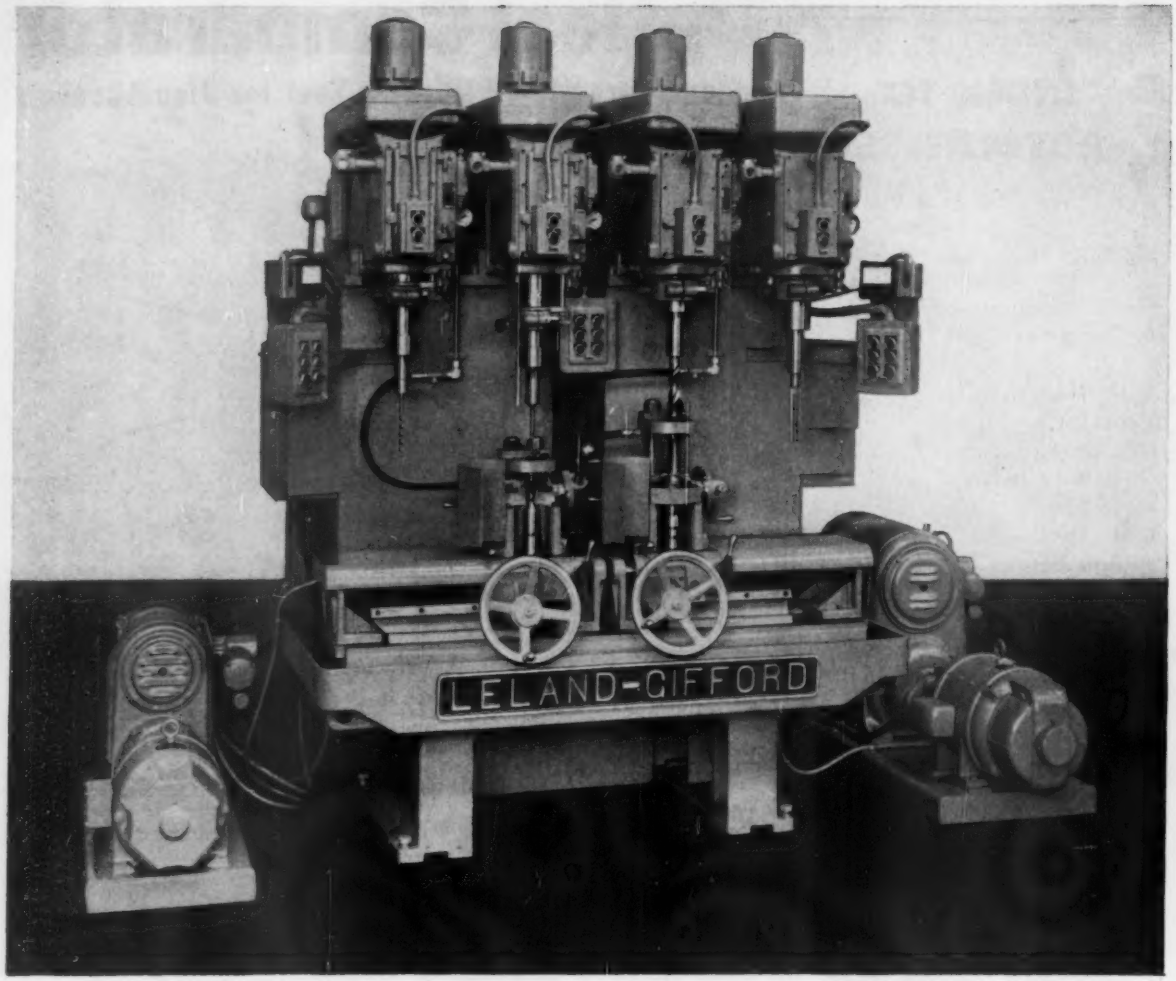

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It goes without saying that Leland-Gifford special drilling machines deliver the production you want to the precision standards you set. But Leland-Gifford also has in mind the importance of design for maximum utilization to make your purchase of a Leland-Gifford machine a gilt-edge, quick return investment.

For Automatic Drilling at its best . . . be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill and ream a complete line of screw machine master collets and feed fingers ranging from ⅛" to 1¼" diameter.

THE MACHINE: A dual operating Leland-Gifford special with two work-holding fixtures and four standard self-contained drilling units equipped for either plain or step feed. Workpieces are drilled in one location, indexed to second location and reamed. Spindle speeds are precisely controlled through variable frequency input to ac spindle motors. Hydraulic feed is infinitely adjustable with separate motors driving hydraulic pumps at constant speed regardless of spindle speed.

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Cleveland 22
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South Orange, N.J.
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How many employees in your plant?

1 ☐ Under 20
3 ☐ 20-49
4 ☐ 50-99
5 ☐ 100-249
6 ☐ 250-499
7 ☐ 500-999
8 ☐ 1000 and Over

What is major product manufactured at your plant?

_____

_____

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October 16, 1961

AM/MM

(This card expires December 17, 1961)

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CIRCLE 252 READER SERVICE CARD

BALAS COLLET MFG. CO. reports...

"tool life up... rejects down, with switch to TIMKEN® STEEL"

Balas Collet Manufacturing Co. chose to make their collets from Timken® alloy steel to help reduce production costs. Controlled grain size and annealing increased their tool life and reduced their machining costs. Controlled analysis resulted in more uniform results in heat treating. Less warpage was experienced in the heat treating process.

Because of the uniform machinability and hardenability, of the Timken alloy steel, savings started immediately. Tool life increased, machining costs fell. Production rates increased and rejections dropped. Balas reports less breakage and longer life for their collets.

Timken steel helps make savings, improve products, because we guard its quality at every manufacturing step. And from bar to bar, order to order, the high quality of Timken steel machining bars is uniform. They machine fast, easily and with good surface. Scrap loss is reduced, machining time is saved. Product quality is maintained.

Timken Company steel experts will gladly work with you on your machining bar requirements. They'll help you select the analysis that will do the best job at lowest cost. Write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Makers of Tapered Roller Bearings, Fine Alloy Steel and Rock Bits.

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